



FCC/ISED Test Report

For:
Xirgo Technologies, LLC

Model:
XT4971A

Product Description:
Solar Energy Harvesting Smart Trailer Solution

FCC ID: GKM-XT4971A
IC ID: 10281A-XT4971A

Per:
47 CFR: Part 22, Part 24, Part 27
RSS-130; RSS-132 Issue 3; RSS-133 Issue 6; RSS-139 Issue 3

REPORT #: EMC_XIRGO-117-17001_FCC_22_24_27-ISED

DATE: 10/26/2017



A2LA Accredited

IC recognized #
3462B-2

CETECOM Inc.

411 Dixon Landing Road ♦ Milpitas, CA 95035 ♦ U.S.A.

Phone: + 1 (408) 586 6200 ♦ Fax: + 1 (408) 586 6299 ♦ E-mail: info@cetecom.com ♦ <http://www.cetecom.com>

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1 Assessment

The following device as further described in section 3 of this report was evaluated against selected applicable criteria specified in the Code of Federal Regulations Title 47 parts 22, 24, 27 and ISED Industry Canada Radio Standard Specifications RSS:130, 132 Issue 3, 133 Issue 6, and 139 Issue 3.

No deficiencies were ascertained.

Company Name	Product Description	Model
Xirgo Technologies, LLC	Solar Energy Harvesting Smart Trailer Solution	XT4971A

Responsible for Testing Laboratory:

Peter Nevermann
 (Director Radio Communications and EMC)

10/26/2017	Compliance		
Date	Section	Name	Signature

Responsible for the Report:

Issa Ghanma
 (EMC Engineer)

10/26/2017	Compliance		
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Section 3. CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.



2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Director Radio Com. and EMC:	Peter Nevermann
Responsible Project Leader:	Issa Ghanma

2.2 Identification of the Client

Applicant's Name:	Xirgo Technologies, LLC
Street Address:	188 Camino Ruiz
City/Zip Code	Camarillo, CA 93012
Country	USA
Contact Person:	Shawn Aleman
Phone No.	805-426-5243
e-mail:	Saleman@Xirgotech.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Applicant
Manufacturers Address:	-----
City/Zip Code	-----
Country	-----



3 Equipment Under Test (EUT)

3.1 EUT Specifications

Model No		XT4971A			
HW Version		XT4971A-001			
SW Version		XT4971A-01			
FCC-ID:		GKM-XT4971A			
IC-ID:		10281A-XT4971A			
FWIN:		N/A			
HVIN:		N/A			
PMN:		XT4971A			
Product Description		Solar Energy Harvesting Smart Trailer Solution			
Module Information		Module: Ublox TOBY-R202			
Mode	LTE	Band	UL Frequency (MHz)	DL Frequency (MHz)	Modulation
		2	1850.7 ~ 1909.3	1930.7 ~ 1989.3	QPSK, 16QAM
		4	1710.7 ~ 1754.3	2110.7 ~ 2154.3	QPSK, 16QAM
		5	824.7 ~ 848.3	869.7 ~ 893.3	QPSK, 16QAM
		12	699 ~ 716	729 ~ 746	QPSK, 16QAM
		13	777 ~ 787	746 ~ 756	QPSK, 16QAM
	WCDMA	II	1852.4 ~ 1907.6	1932.4 ~ 1987.6	QPSK
		V	826.4 ~ 846.6	871.4 ~ 891.6	QPSK
Max. documented antenna gain		3.17 dBi			
Max. documented average conducted output power including tune up		WCDMA Band II: 25.99 dBm WCDMA Band V: 26.02 dBm LTE Band 2: 23.27 dBm LTE Band 4: 23.62 dBm LTE Band 5: 23.09 dBm LTE Band 12: 23.5 dBm			
Operating Voltage Range		8 VDC to 24VDC			
Operating Temperature Range		-40°C to 70°C			
Other Radios included in the device		Bluetooth and Zigbee			



Sample Revision	<input type="checkbox"/> Prototype Unit; <input type="checkbox"/> Production Unit; <input checked="" type="checkbox"/> Pre-Production
EUT Dimensions	8.45" x 4.73" x 1.06" (21.5 cm x 12 cm x 2.6 cm)
EUT Diameter	<input checked="" type="checkbox"/> < 60 cm <input type="checkbox"/> Other _____

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Comments
1	SN1	XT4971A-001	XT4971A-01	Radiated Measurements

3.3 Test Sample Configuration

Set-up #	EUT / AE used for set-up	Comments
1	EUT #1	Radiated Measurements

4 Subject of Investigation

The objective of the evaluation conducted by CETECOM Inc. is to support a request for new equipment authorization under FCC ID: GKM-XT4971A / IC ID: 10281A-XT4971A

According to the guidelines from FCC KDB 996369 for the product under evaluation, and the pre-certified module to be integrated (Ublox TOBY-R202) as described in Section 3, the output power has been verified to be within the specified production tolerances and measurement uncertainties, and where relevant test procedures did not change the conducted test results from module certification are re-used. Full Radiated Spurious Emissions test was conducted, per Code of Federal Regulations Title 47 parts 22, 24, 27, and Industry Canada Radio Standard Specifications RSS:130, 132 Issue 3, 133 Issue 6, and 139 Issue 3.

The module test data can be obtained under the FCC Filing ID: XPY1EHQ24NN/ IC ID: 8595A-1EHQ24NN

4.1 Dates of Testing:

7/26/2017 – 10/7/2017

4.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=1.

Radiated measurement

9 kHz to 30MHz	±2.5 dB (Magnetic Loop Antenna)
30 MHz to 1000 MHz	±2.0 dB (Biconilog Antenna)
1 GHz to 40 GHz	±2.3 dB (Horn Antenna)

Conducted measurement

RF conducted measurement	±0.5 dB
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4.3 Environmental Conditions during Testing:

The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25°C
- Relative humidity: 40-60%

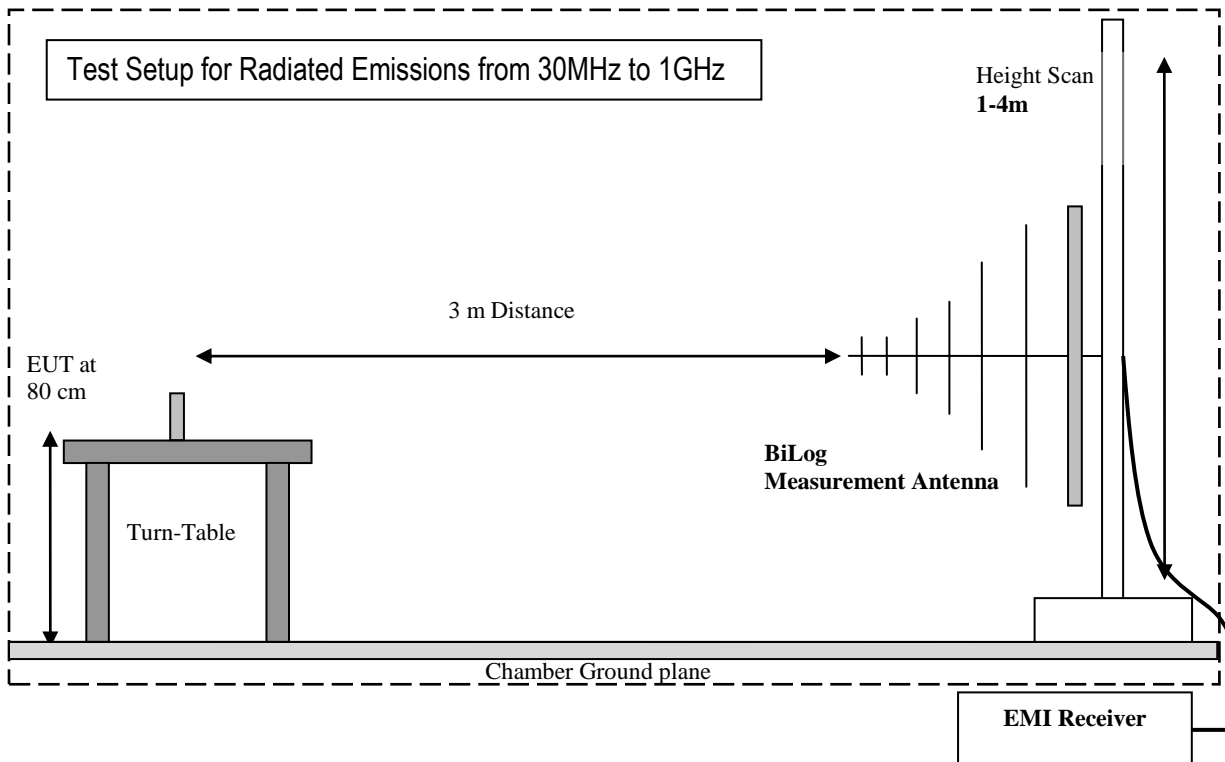
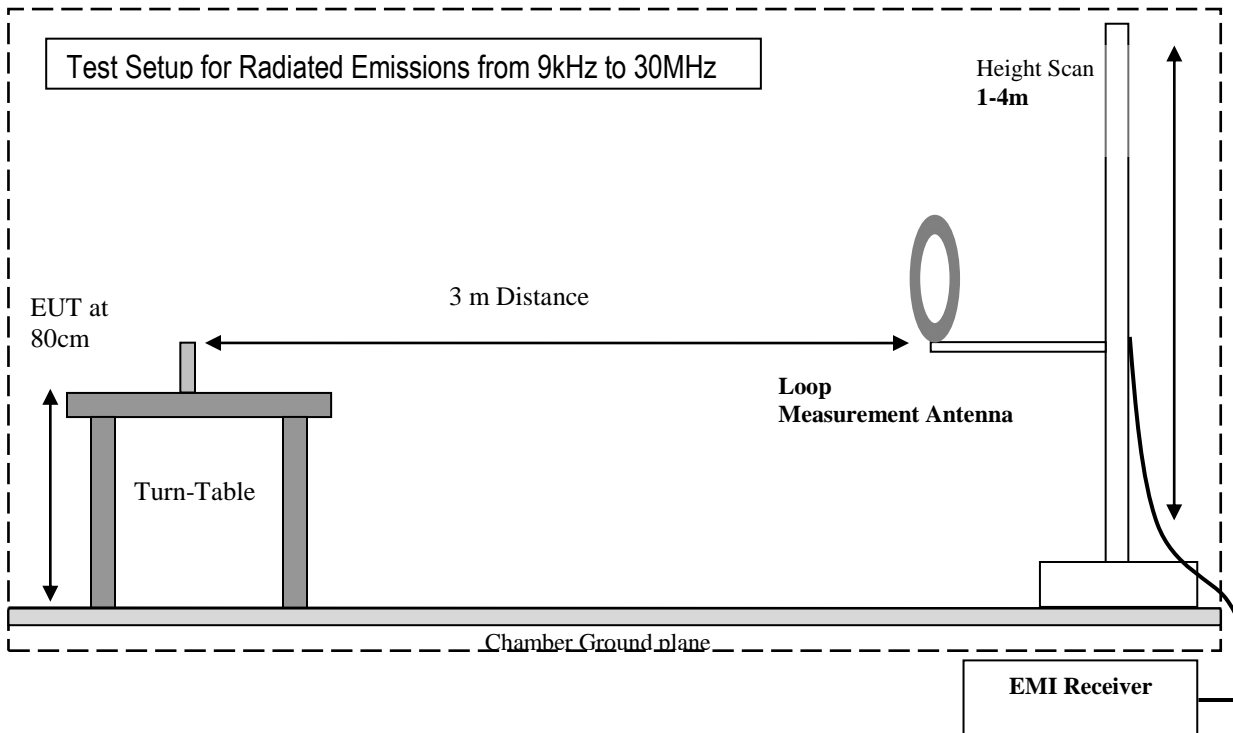
Deviating test conditions are indicated at individual test description where applicable.

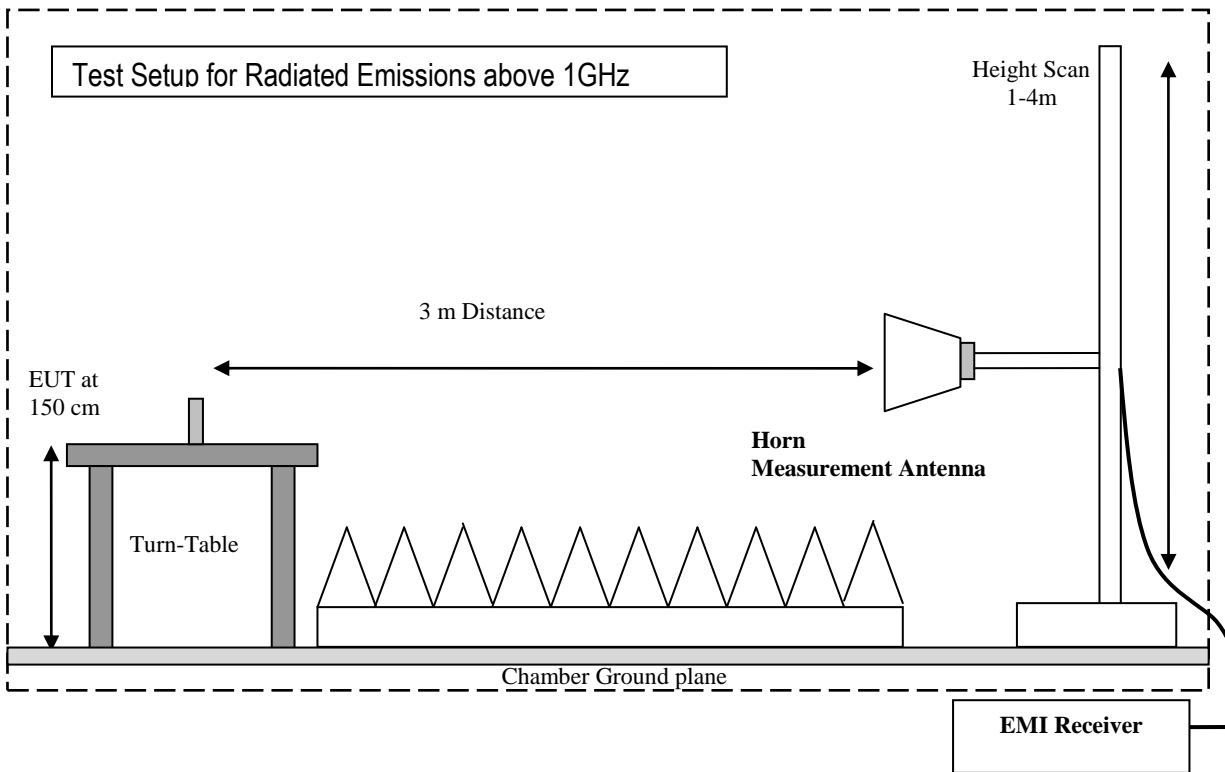
5 Measurement Procedures

Testing is performed according to the guidelines provided in FCC publication (KDB) 971168 D01 v02r02 – “Measurement Guidance for Certification of Licensed Digital Transmitters” and according to relevant parts of TIA-603C 2004 as detailed below.

5.1 Radiated Measurement

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.





5.2 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

- Measured reading in dB μ V
- Cable Loss between the receiving antenna and SA in dB and
- Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

$$FS \text{ (dB}\mu\text{V/m)} = \text{Measured Value on SA (dB}\mu\text{V)} - \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$$

Example:

Frequency (MHz)	Measured SA (dB μ V)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dB μ V/m)
1000	80.5	3.5	14	98.0



6 Measurement Results Summary

6.1 FCC 22, RSS-132:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046; §22.913 (a)	RF Output Power	Nominal	UMTS LTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Complies Note 2
§2.1055; §22.355	Frequency Stability	Nominal	UMTS LTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Complies Note 2
§2.1049; §22.917	Occupied Bandwidth	Nominal	UMTS LTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Complies Note 2
§2.1051; §22.917	Band Edge Compliance	Nominal	UMTS LTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Complies Note 2
§2.1051; §22.917	Conducted Spurious Emissions	Nominal	UMTS LTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Complies Note 2
§2.1053; §22.917(a); RSS-132 Issue 3-5.5	Radiated Spurious Emissions	Nominal	UMTS LTE	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Complies

Note 1: NA= Not Applicable; NP= Not Performed.

Note 2: Leveraged from module certification Ublox Toby-R202 FCC ID: XPY1EHQ24NN / IC ID: 8595A-1EHQ24NN

6.2 FCC 24, RSS-133:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046; §24.232 (a)	RF Output Power	Nominal	UMTS LTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Complies Note 2
§2.1055; §24.235	Frequency Stability	Nominal	UMTS LTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Complies Note 2
§2.1049; §24.238	Occupied Bandwidth	Nominal	UMTS LTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Complies Note 2
§2.1051; §24.238	Band Edge Compliance	Nominal	UMTS LTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Complies Note 2
§2.1051; §24.238	Conducted Spurious Emissions	Nominal	UMTS LTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Complies Note 2
§2.1053; §24.238(a); RSS-133 Issue 6-6.5.1	Radiated Spurious Emissions	Nominal	UMTS LTE	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Complies

Note 1: NA= Not Applicable; NP= Not Performed.

Note 2: Leveraged from module certification Ublox Toby-R202 FCC ID: XPY1EHQ24NN / IC ID: 8595A-1EHQ24NN



6.3 FCC 27, RSS-130, RSS-139:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046; §27.50 (d)	RF Output Power	Nominal	UMTS LTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Complies Note 2
§2.1055; §27.54	Frequency Stability	Nominal	UMTS LTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Complies Note 2
§2.1049; §27.53	Occupied Bandwidth	Nominal	UMTS LTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Complies Note 2
§2.1051; §27.53	Band Edge Compliance	Nominal	UMTS LTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Complies Note 2
§2.1051; §27.53	Conducted Spurious Emissions	Nominal	UMTS LTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Complies Note 2
§2.1053; §27.53(g); §27.53(h); RSS-130 Issue 1-4.6; RSS-139 Issue 3-6.6;	Radiated Spurious Emissions	Nominal	UMTS LTE	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Complies

Note 1: NA= Not Applicable; NP= Not Performed.

Note 2: Leveraged from module certification Ublox Toby-R202 FCC ID: XPY1EHQ24NN / IC ID: 8595A-1EHQ24NN



7 Test Result Data

7.1 Radiated Spurious Emissions

7.1.1 Measurement according to FCC: CFR 47 Part 2.1053; CFR Part 22.917; Part 24.238; Part 27.53, utilizing KDB 971168 D01 Power Meas License Digital Systems v02r02, and according to TIA-603C 2004- 2.2.12

Spectrum Analyzer Settings for FCC 22			
Frequency Range	30MHz – 1 GHz	1 – 1.58 GHz	1.58 – 9 GHz
Resolution Bandwidth	100 kHz	1 MHz	1 MHz
Video Bandwidth	100 kHz	1 MHz	1 MHz
Detector	Peak	Peak	Peak
Trace Mode	Max Hold	Max Hold	Max Hold
Sweep Time	Auto	Auto	Auto

Spectrum Analyzer Settings for FCC 24 and 27				
Frequency Range	30MHz – 1 GHz	1 – 2.7 GHz	2.7 – 18 GHz	18 – 19.1 GHz
Resolution Bandwidth	100 kHz	1 MHz	1 MHz	1 MHz
Video Bandwidth	100 kHz	1 MHz	1 MHz	1 MHz
Detector	Peak	Peak	Peak	Peak
Trace Mode	Max Hold	Max Hold	Max Hold	Max Hold
Sweep Time	Auto	Auto	Auto	Auto

7.1.2 Limits:

- FCC Part 22.917 (a), Part 24.238 (a), Part 27.53 (g), and Part 27.53 (h)
- RSS-130-4.6, RSS-132 Issue 3 5.5, RSS-133 Issue 6 6.5.1, RSS-139 Issue 3 6.6

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB = (-13dBm)



7.1.3 Test conditions and setup:

Ambient Temperature (C)	EUT Set-Up #	EUT operating mode	Power Input
22	1	LTE,FDD Cellular	12 VDC

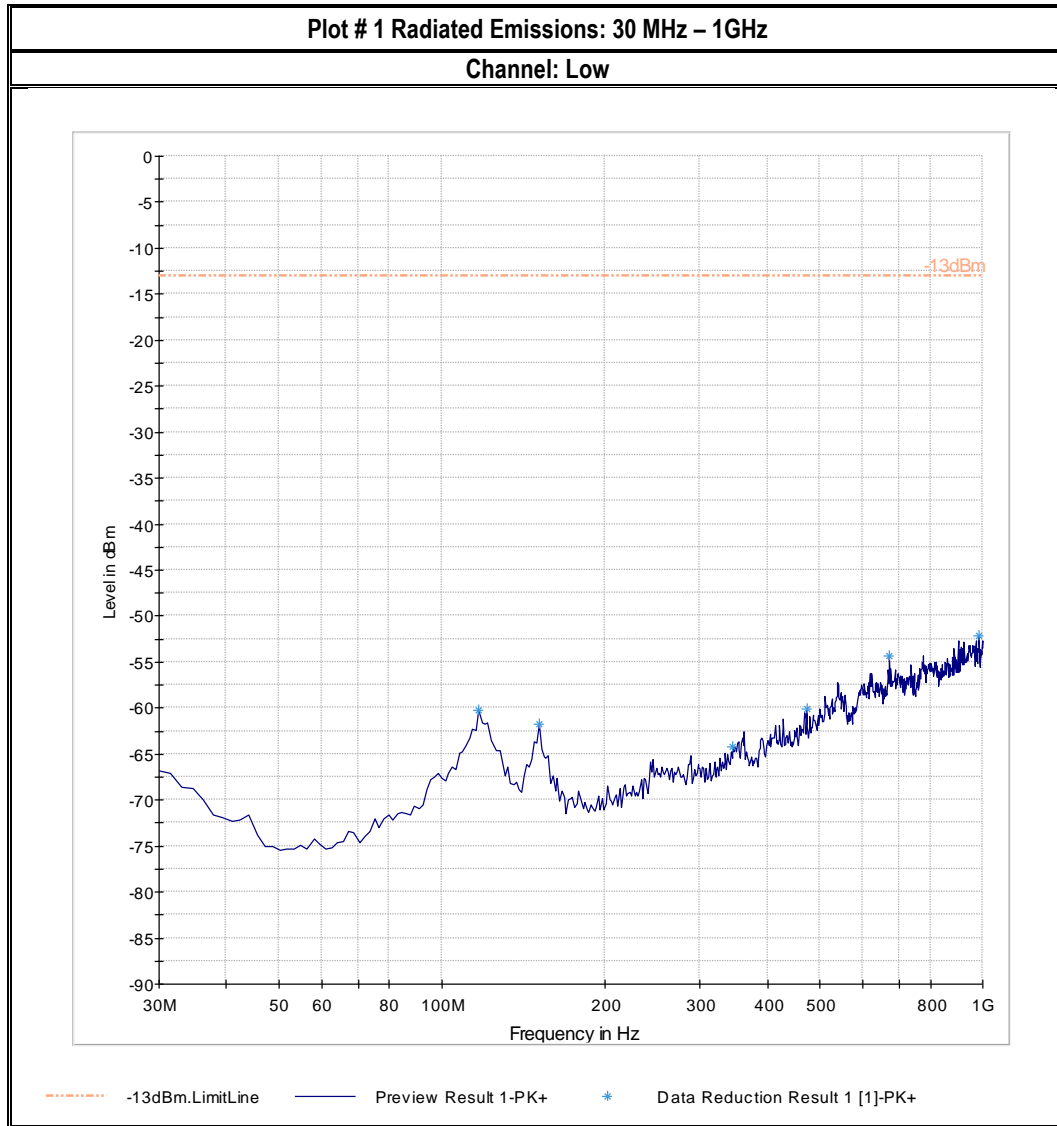
7.1.4 Measurement result:

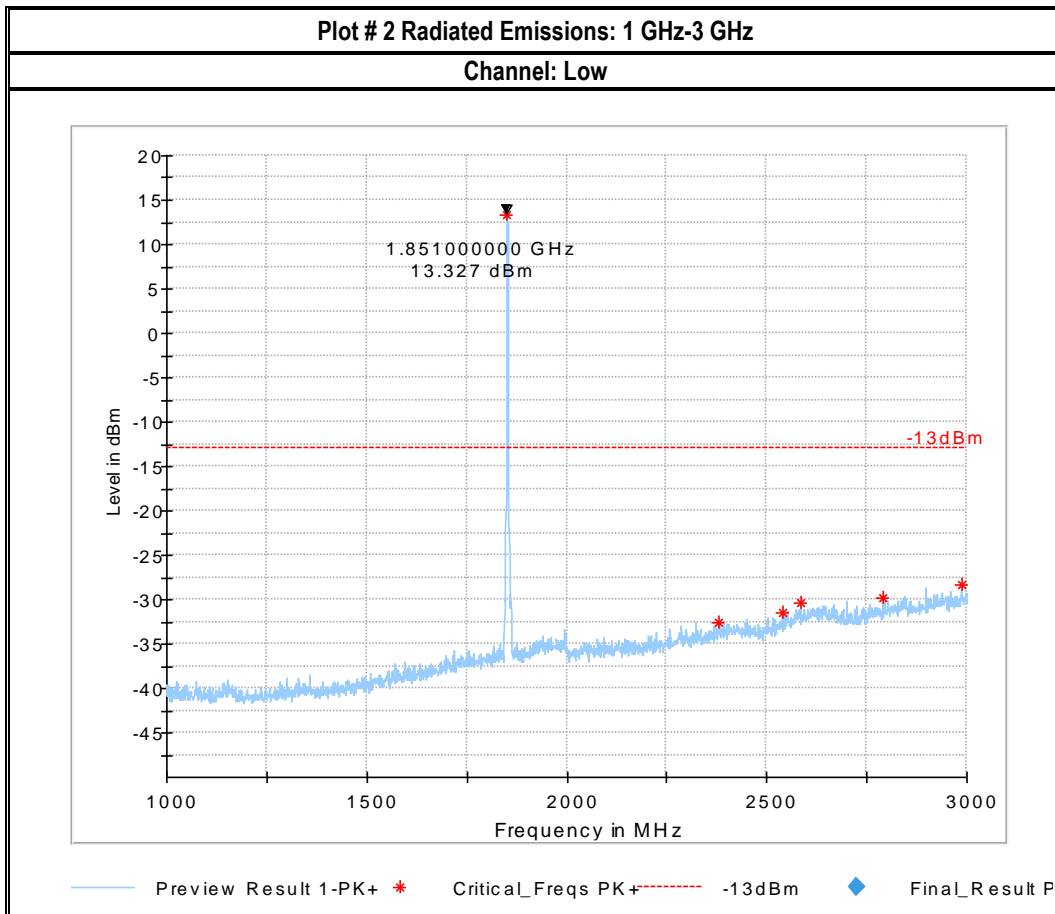
Plot #	Cellular Channel	EUT operating mode	Scan Frequency	Limit (dBm)	Result
1 - 3	Low	FDD II	30 MHz – 18 GHz	-13	Pass
4 - 8	Mid	FDD II	9 kHz – 22 GHz	-13	Pass
9 - 11	High	FDD II	30 MHz – 18 GHz	-13	Pass
12 - 13	Low	FDD V	30 MHz – 9 GHz	-13	Pass
14 - 16	Mid	FDD V	9 kHz – 9 GHz	-13	Pass
17 – 18	High	FDD V	30 MHz – 9 GHz	-13	Pass
19 – 21	Low	LTE 2	30 MHz – 18 GHz	-13	Pass
22 – 26	Mid	LTE 2	9 kHz – 22 GHz	-13	Pass
27 – 29	High	LTE 2	30 MHz – 18 GHz	-13	Pass
30 – 32	Low	LTE 4	30 MHz – 18 GHz	-13	Pass
33 – 36	Mid	LTE 4	9 kHz – 18 GHz	-13	Pass
37 – 39	High	LTE 4	30 MHz – 18 GHz	-13	Pass
40 – 41	Low	LTE 5	30 MHz – 9 GHz	-13	Pass
42 – 44	Mid	LTE 5	9 kHz – 9 GHz	-13	Pass
45 – 46	High	LTE 5	30 MHz – 9 GHz	-13	Pass
47 – 48	Low	LTE 12	30 MHz – 9 GHz	-13	Pass
49 – 51	Mid	LTE 12	9 kHz – 9 GHz	-13	Pass
52 – 53	High	LTE 12	30 MHz – 9 GHz	-13	Pass



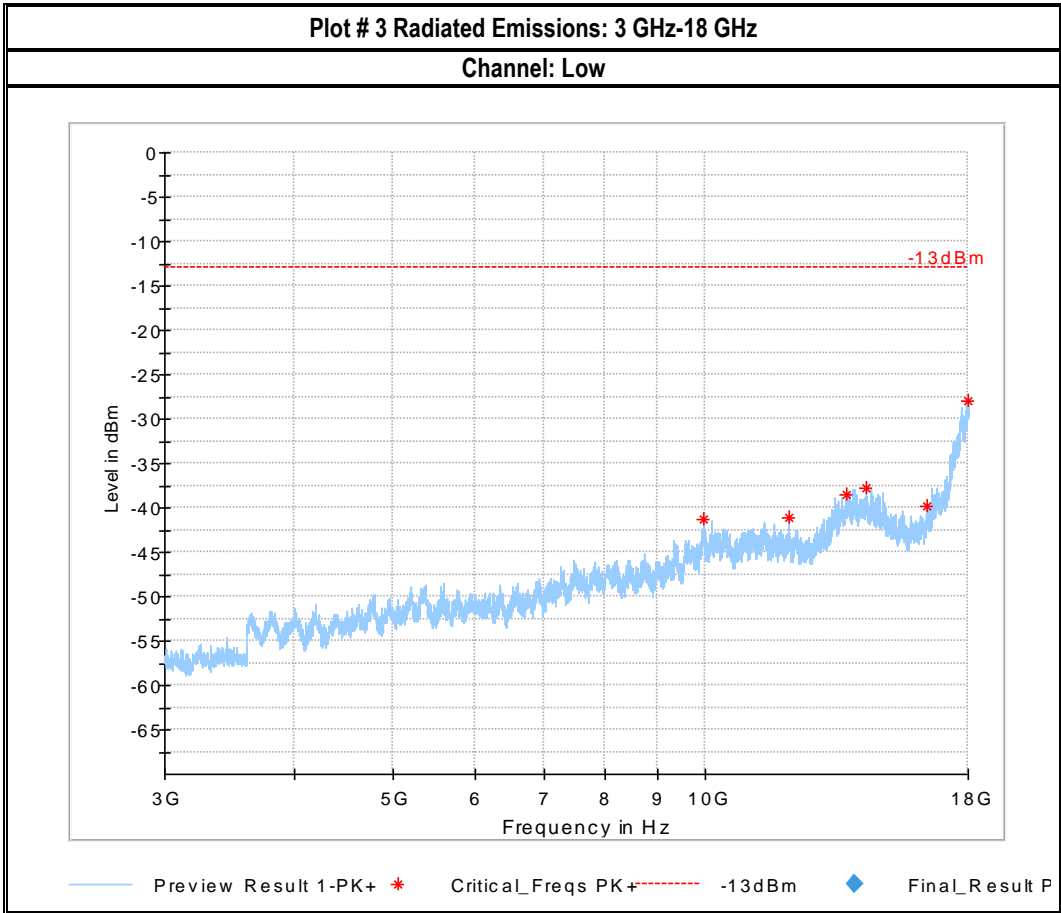
7.1.5 Measurement Plots:

FDD II





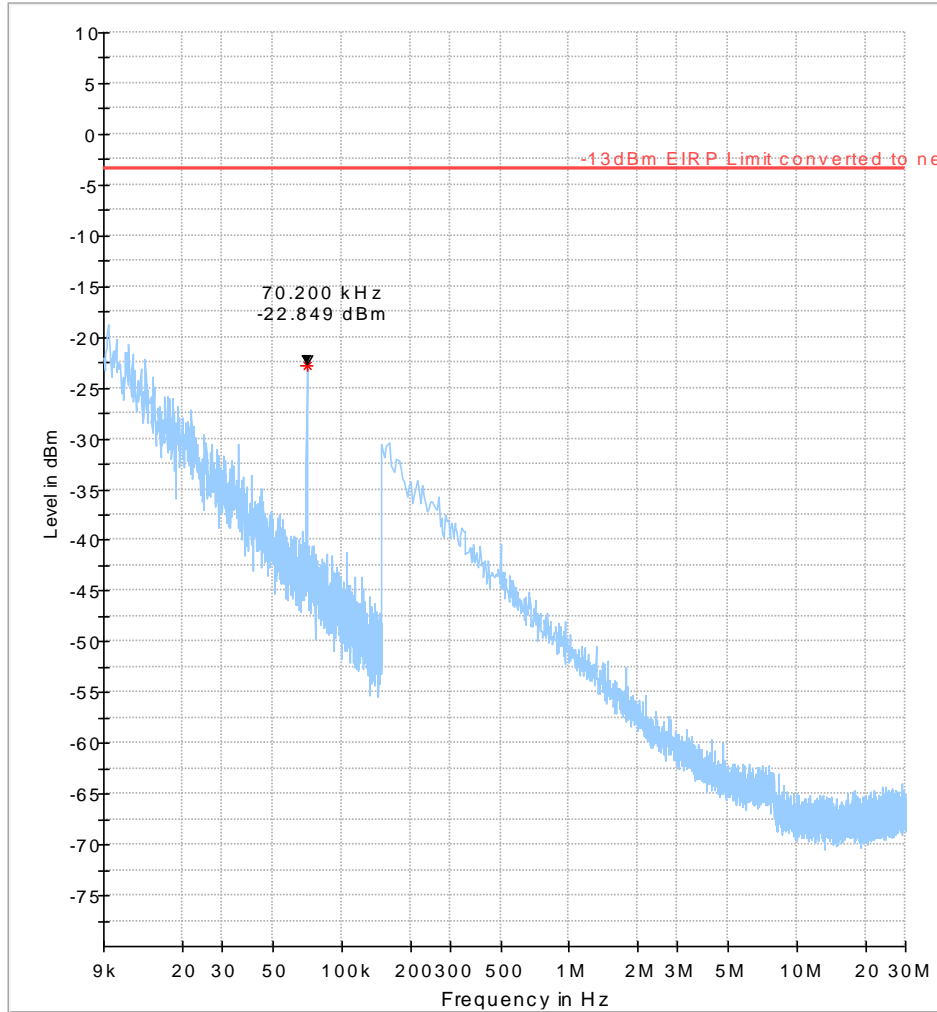
Note: The peak signal above is the transmit channel.



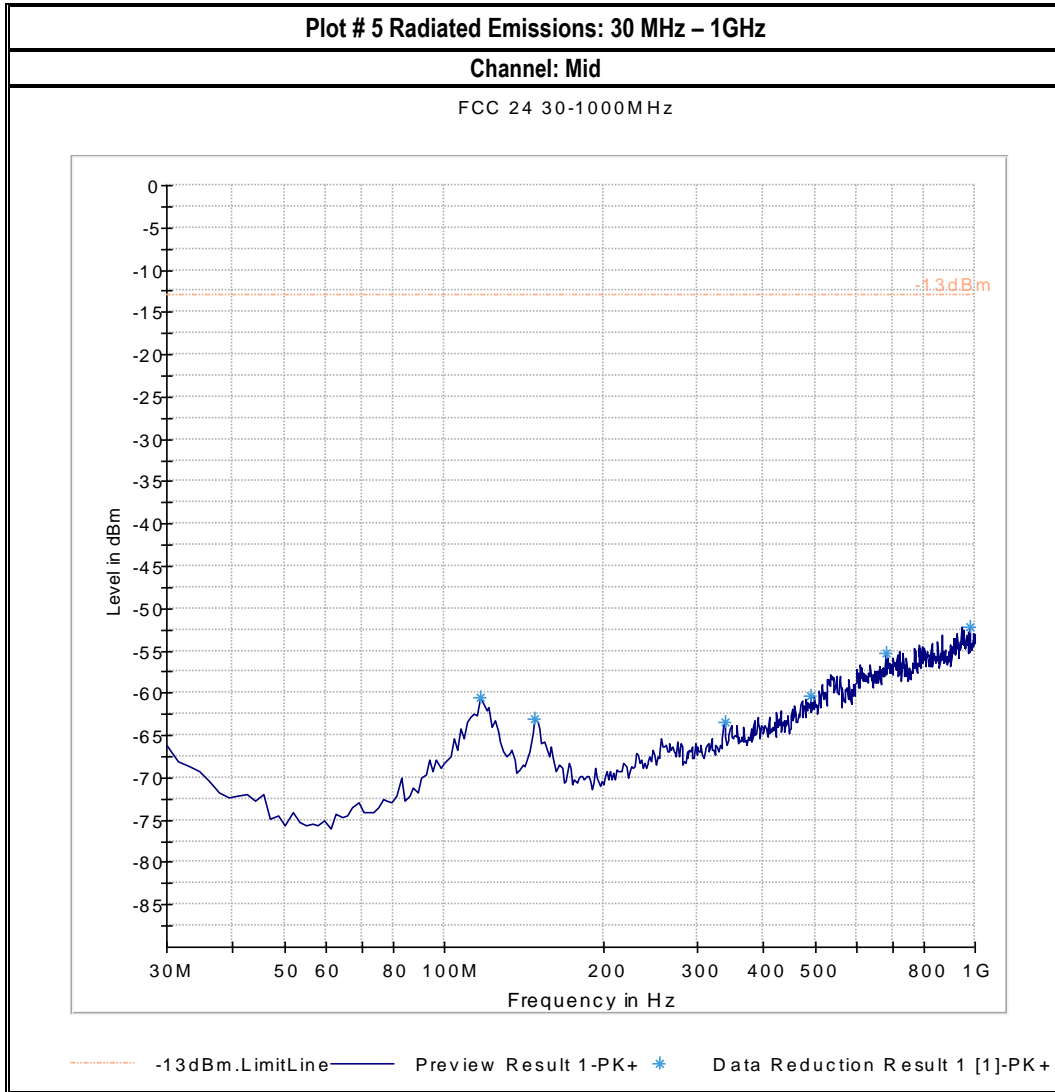


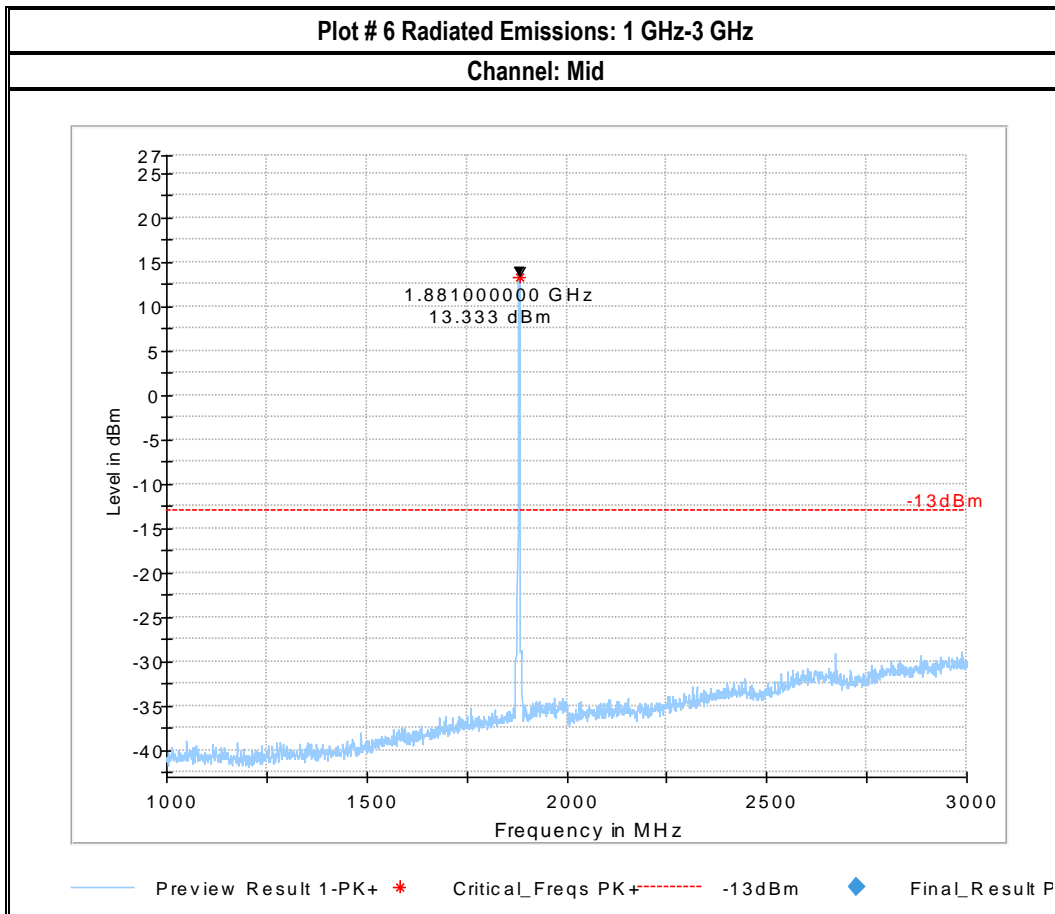
Plot # 4 Radiated Emissions: 9 kHz-30 MHz

Channel: Mid

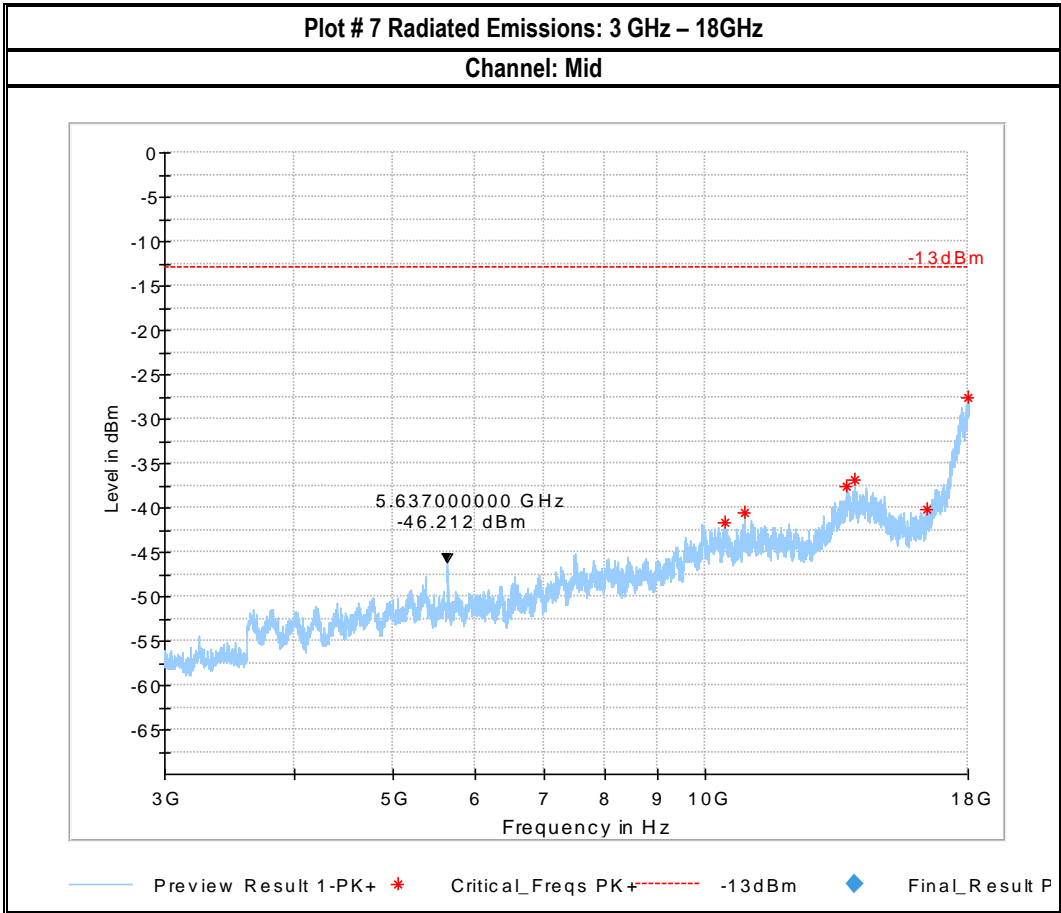


- Preview Result 2-RMS
- Critical_Freqs RMS
- 13dBm EIRP Limit converted to near field
- Preview Result 1-PK+
- Critical_Freqs PK+
- Final_Result RMS





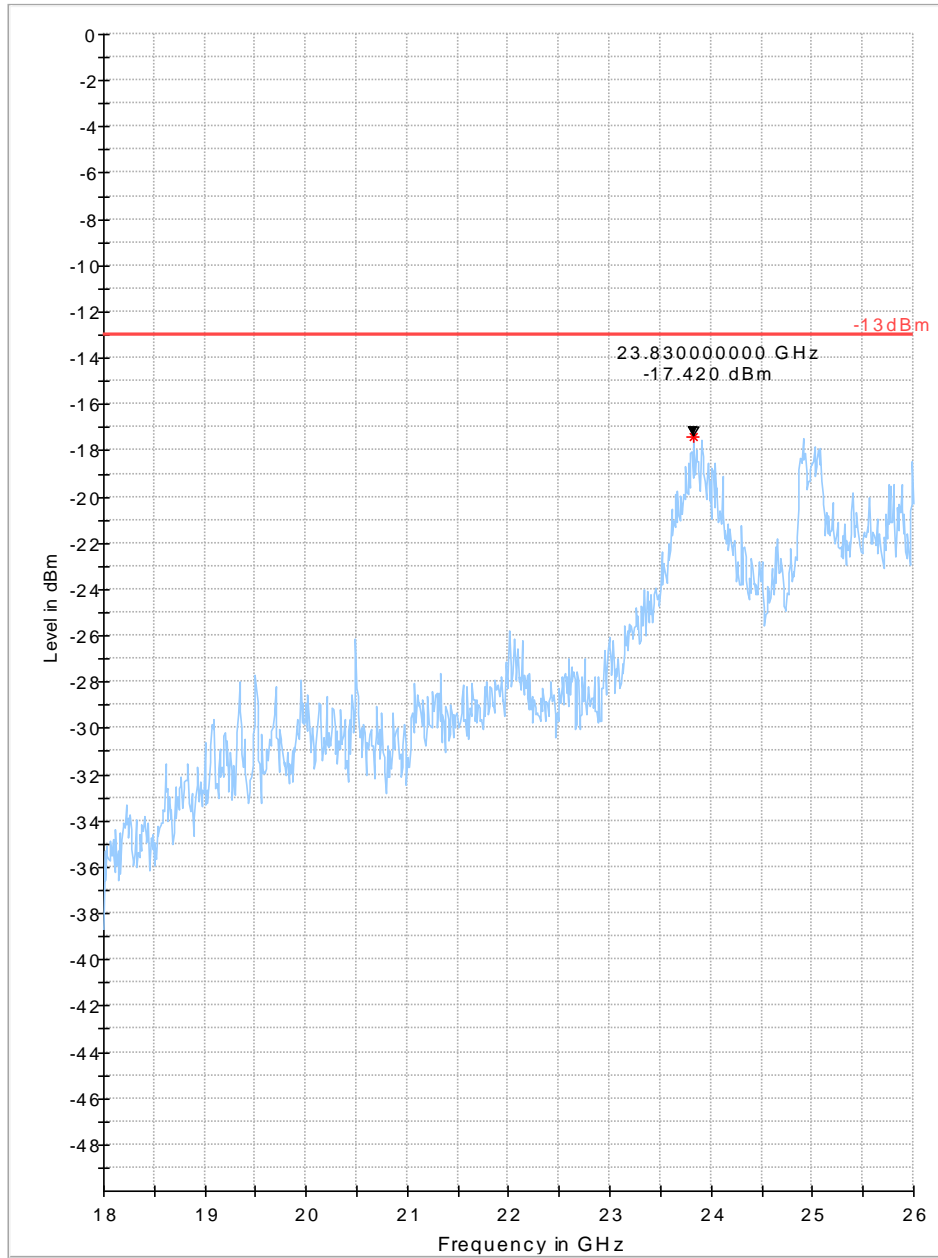
Note: The peak signal above is the transmit channel.



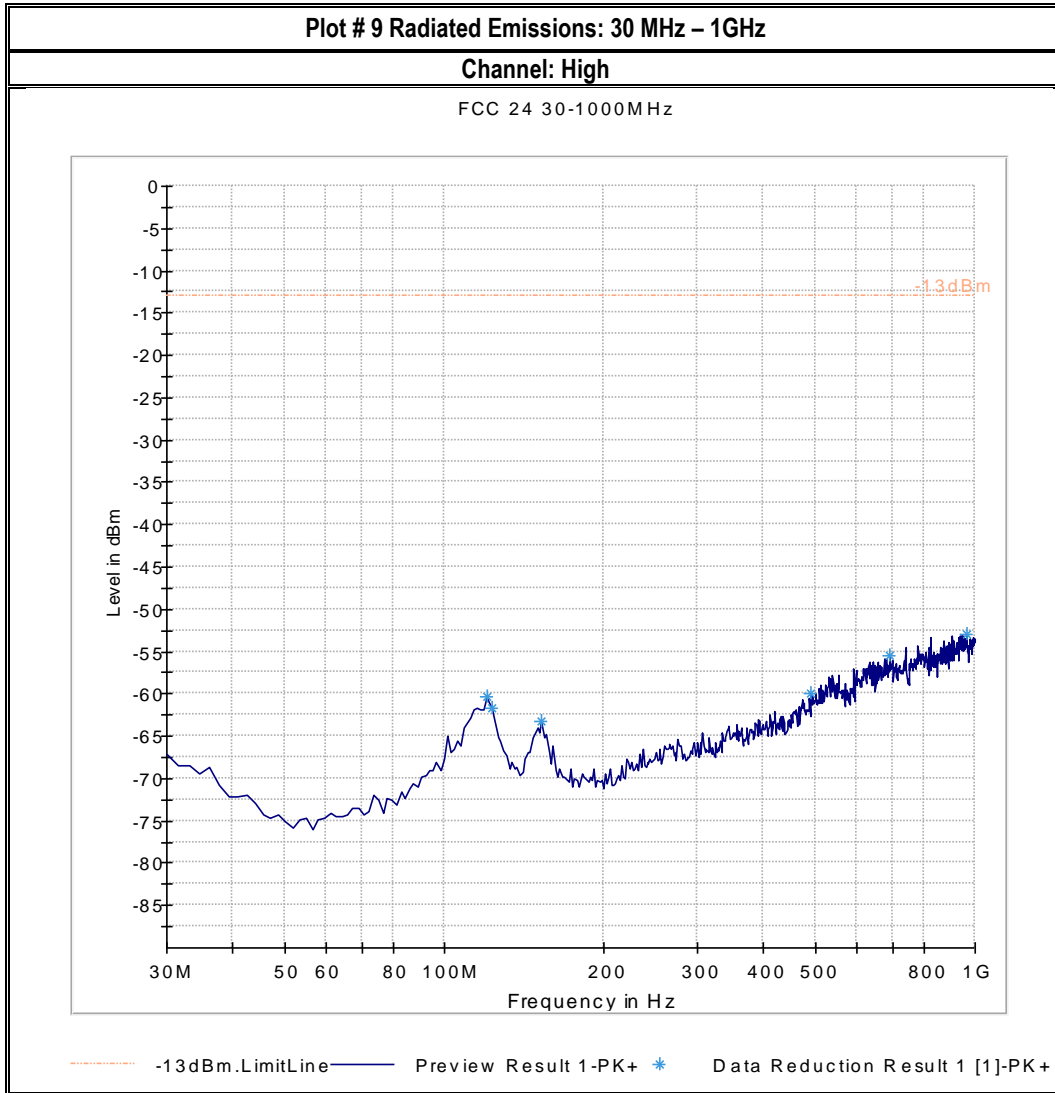


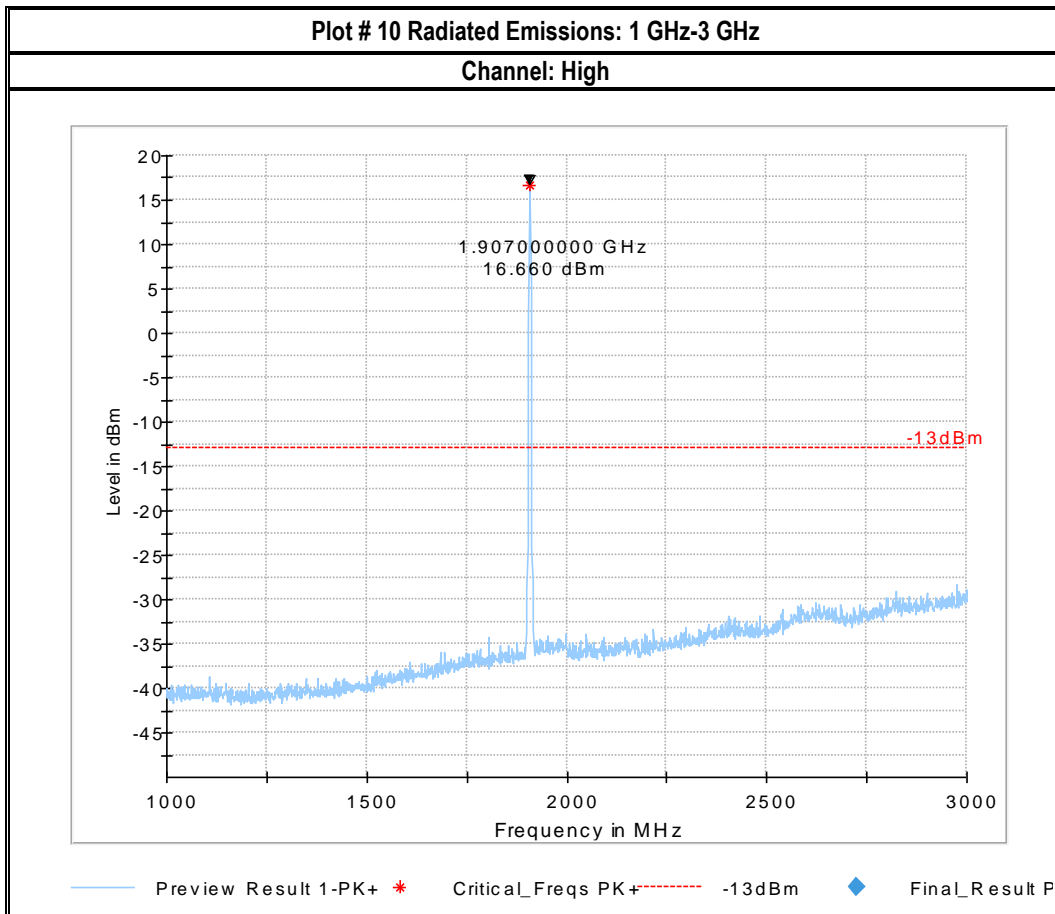
Plot # 8 Radiated Emissions: 18 GHz – 26GHz

Channel: Mid

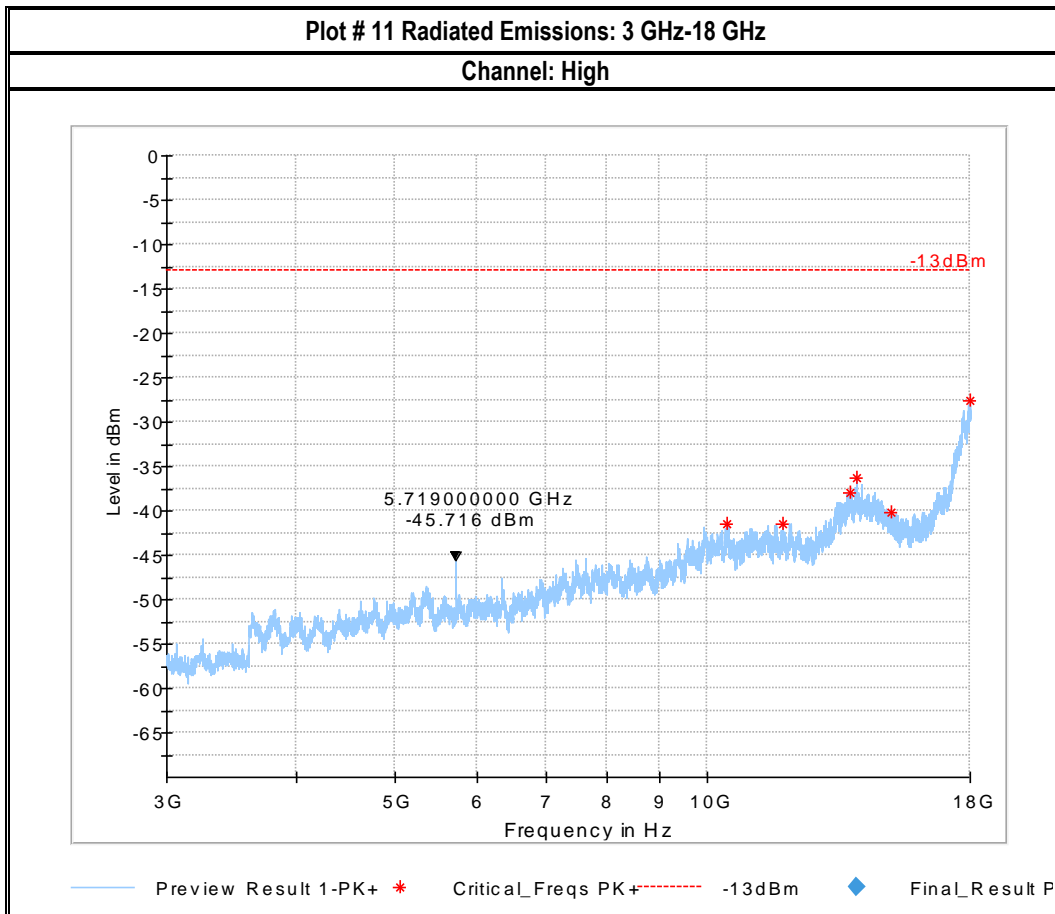


Preview Result 1-PK+ * Critical_Freqs PK+ -13dBm Final_Result P

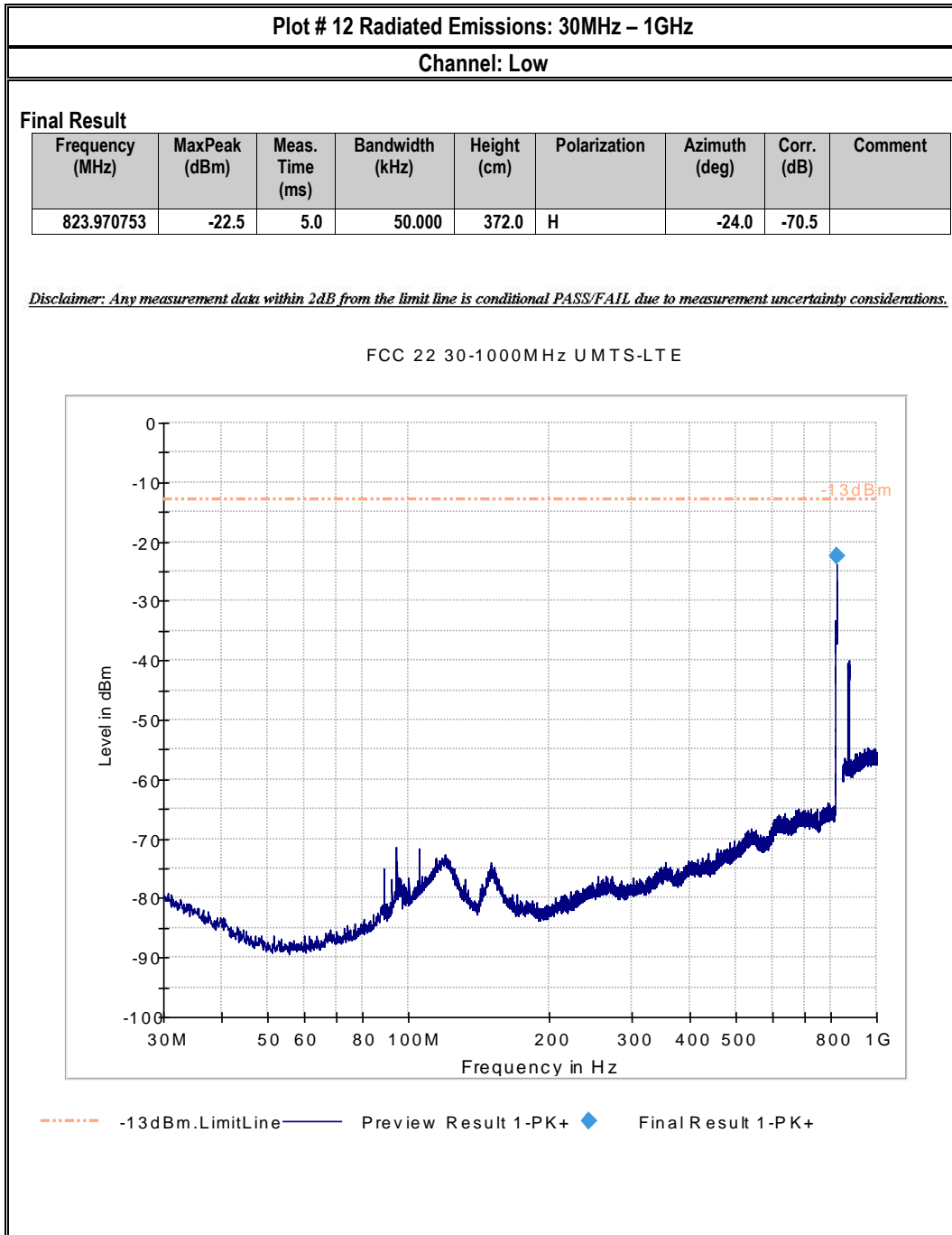




Note: The peak signal above is the transmit channel.



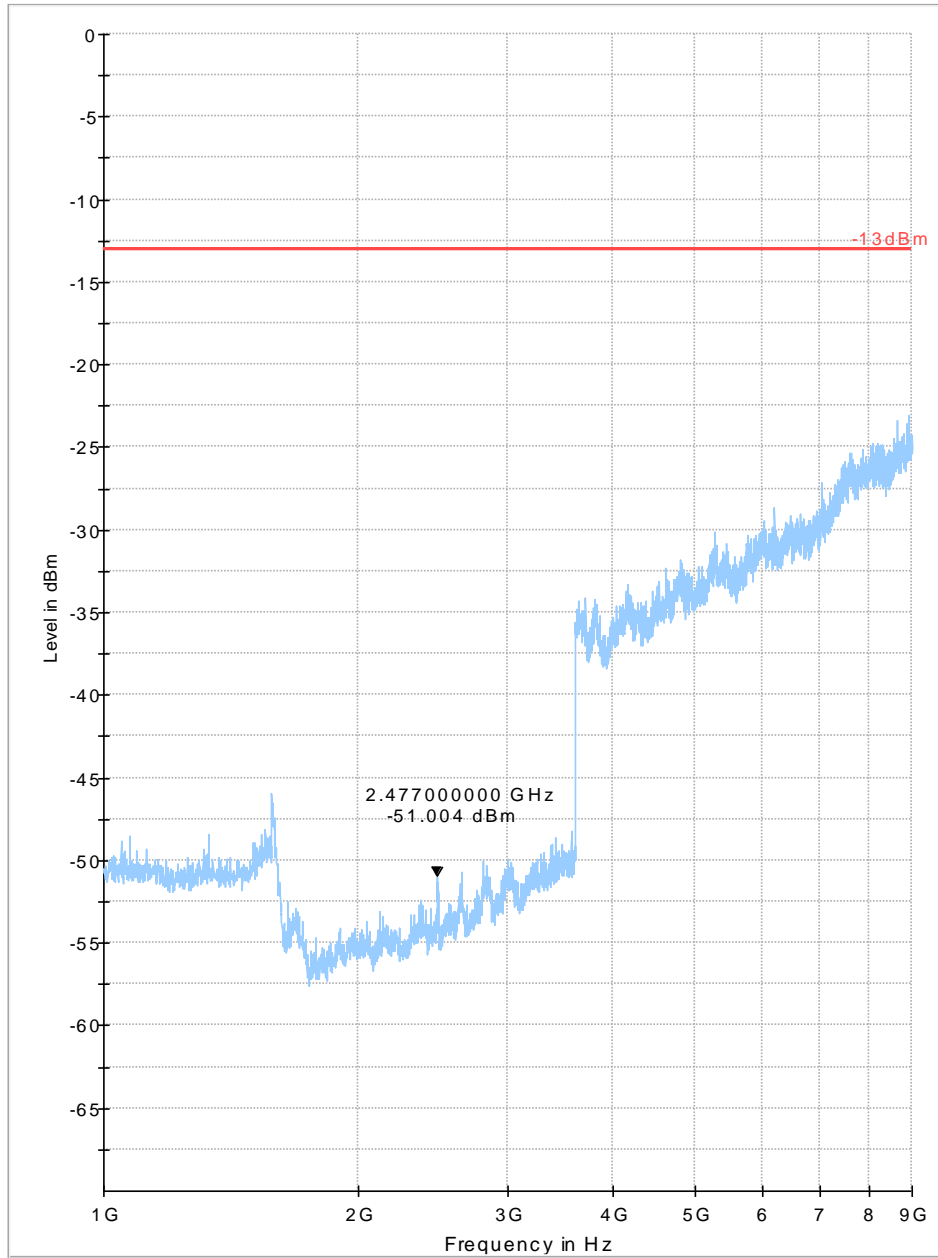
FDD V



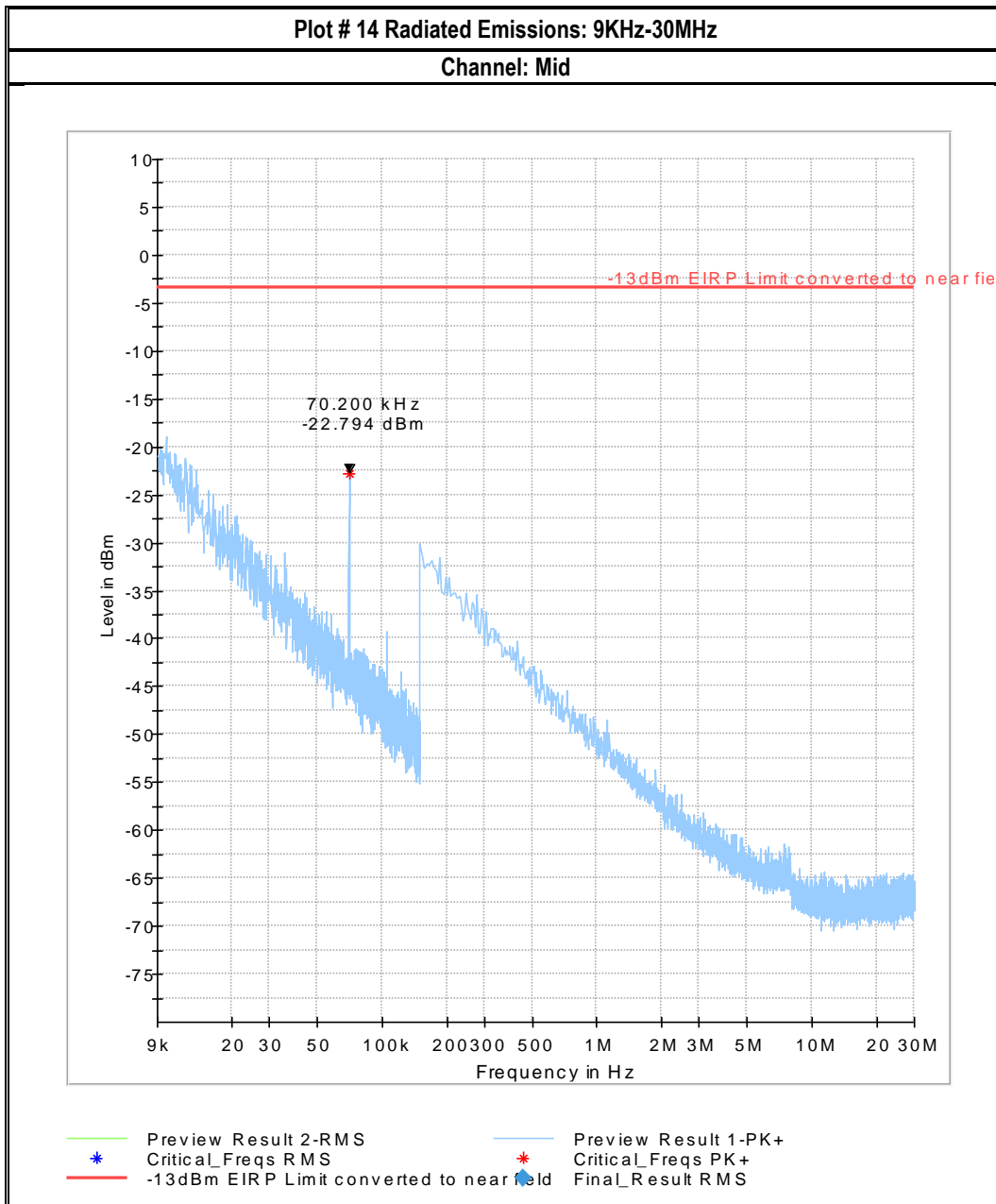


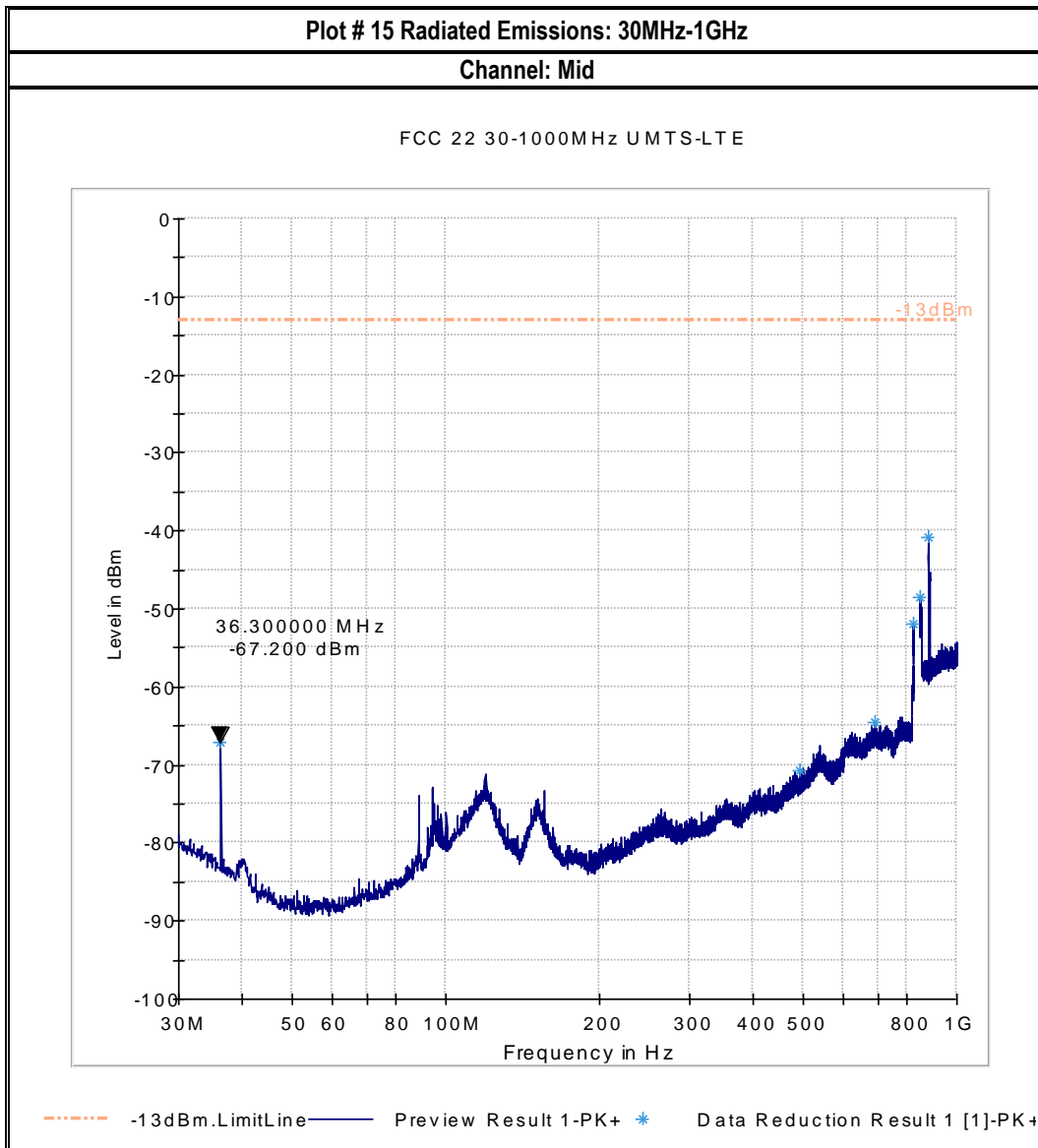
Plot # 13 Radiated Emissions: 1GHz-9GHz

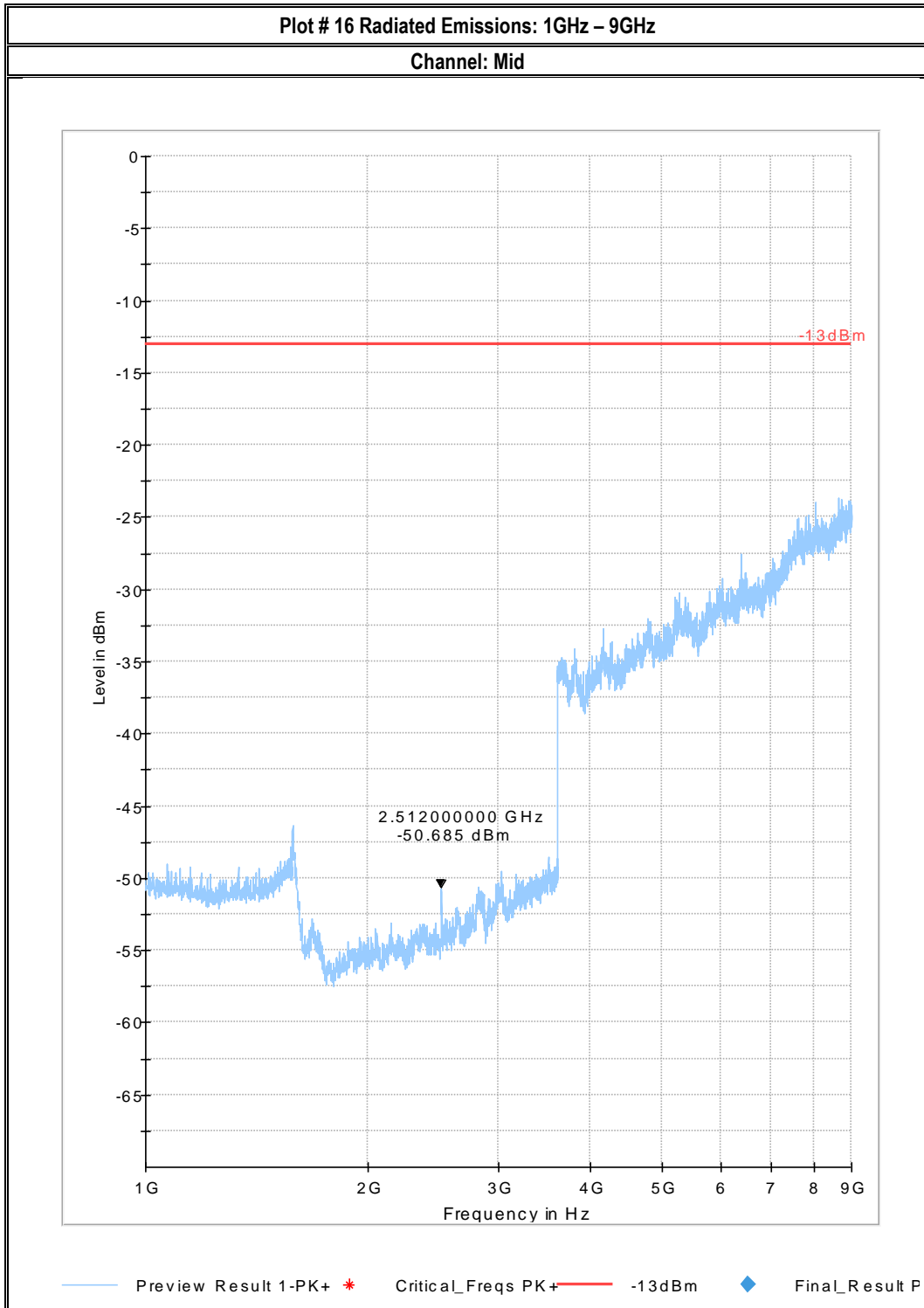
Channel: Low



Preview Result 1-PK+ * Critical_Freqs PK+ -13dBm Final_Result P









Plot #17 Radiated Emissions: 30 MHz – 1 GHz

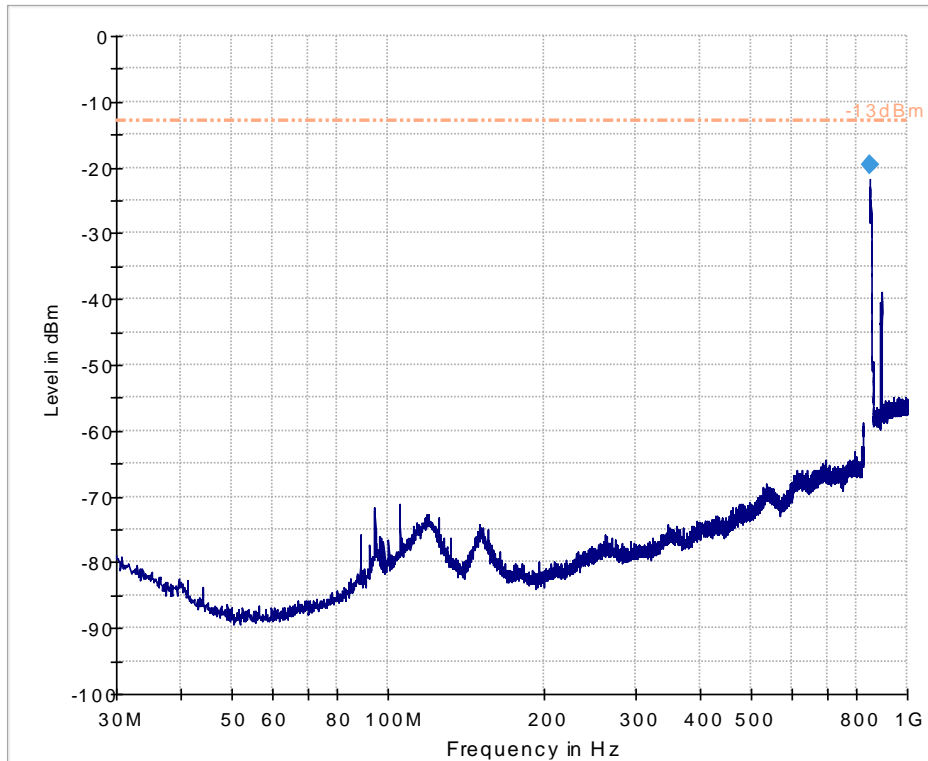
Channel: High

Final Result

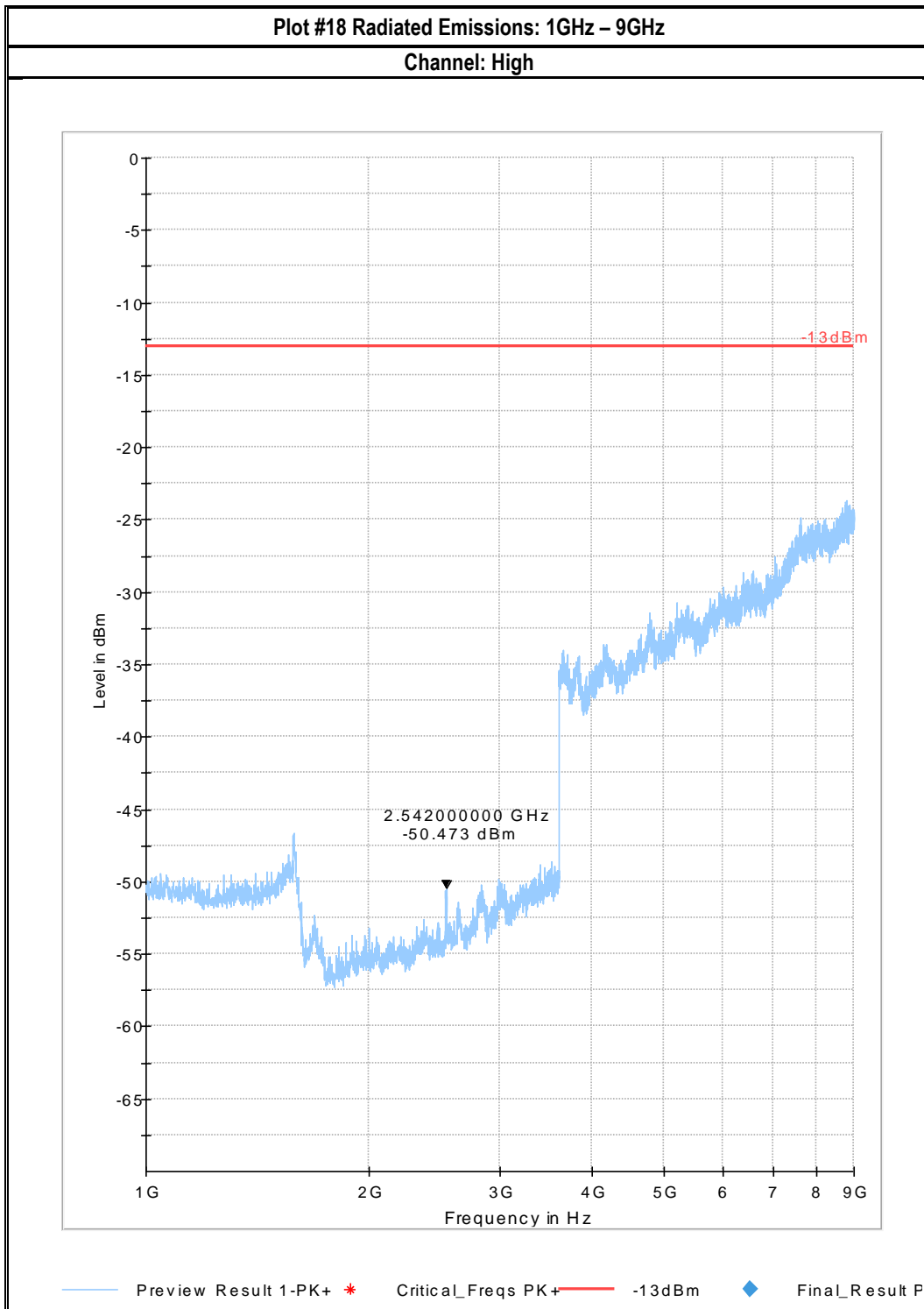
Frequency (MHz)	MaxPeak (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Comment
849.005288	-19.6	5.0	50.000	328.0	H	14.0	-70.4	

Disclaimer: Any measurement data within 2dB from the limit line is conditional PASS/FAIL due to measurement uncertainty considerations.

FCC 22 30-1000MHz UMTS-LTE

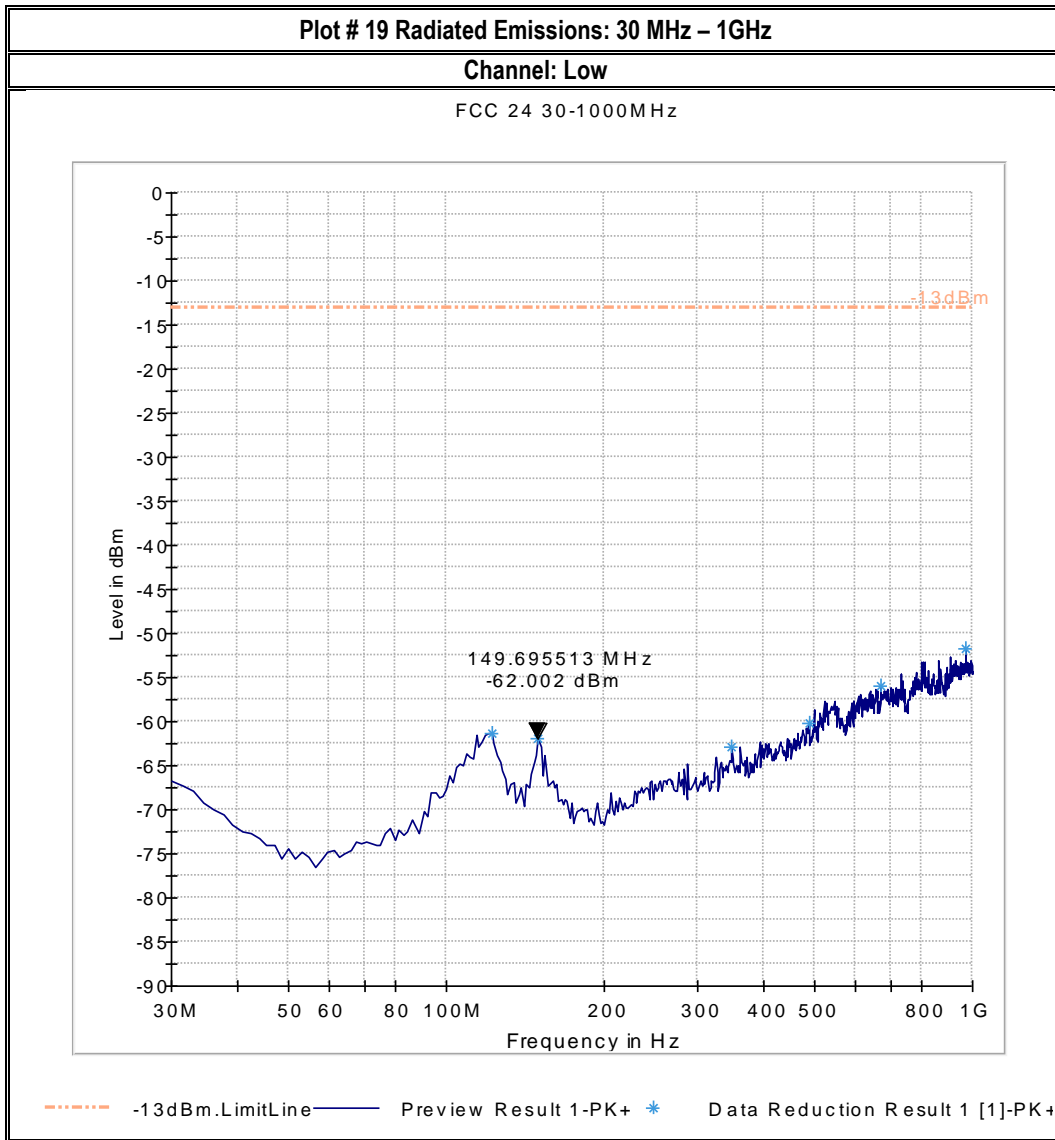


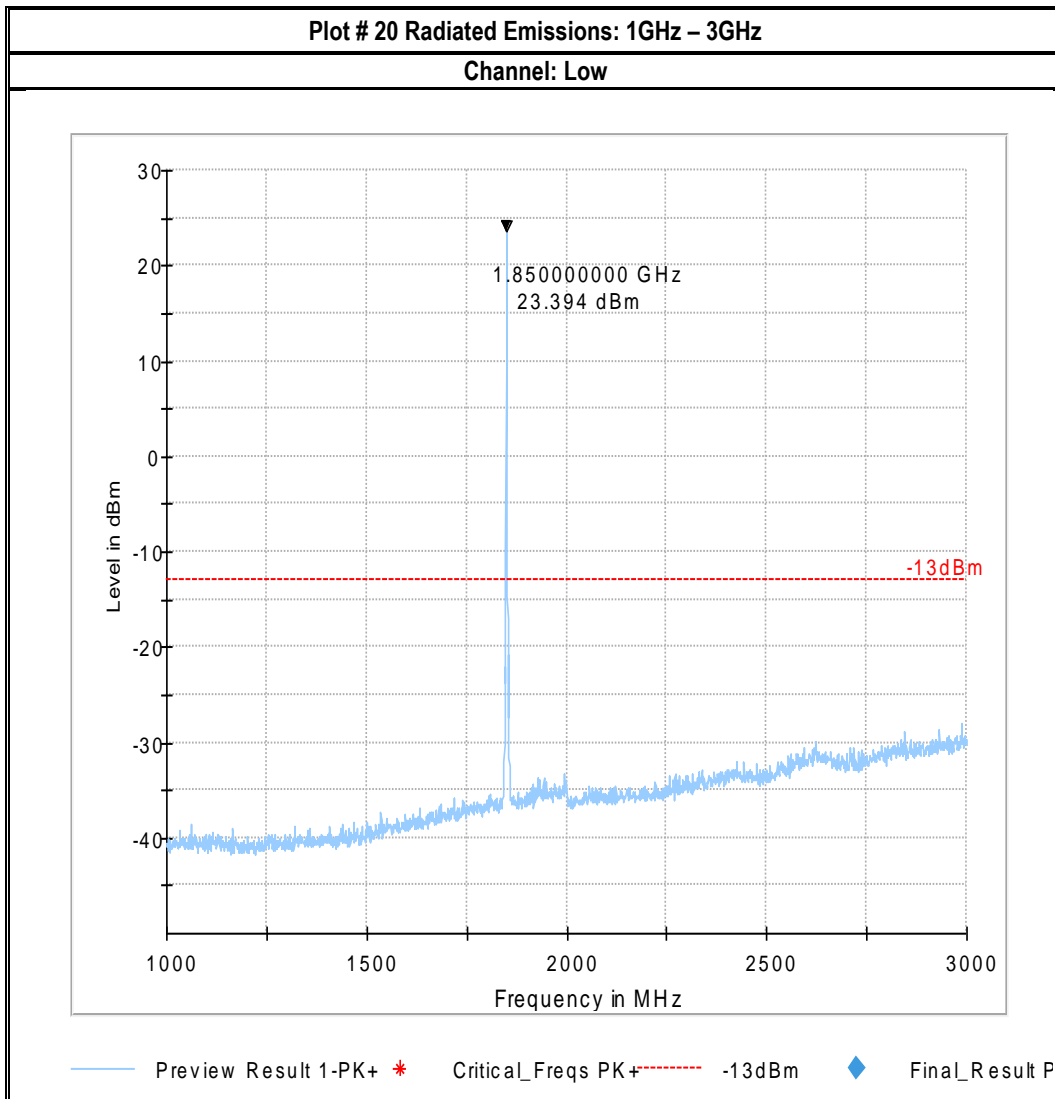
----- -13dBm.LimitLine ——— Preview Result 1-PK+ ◆ Final Result 1-PK+



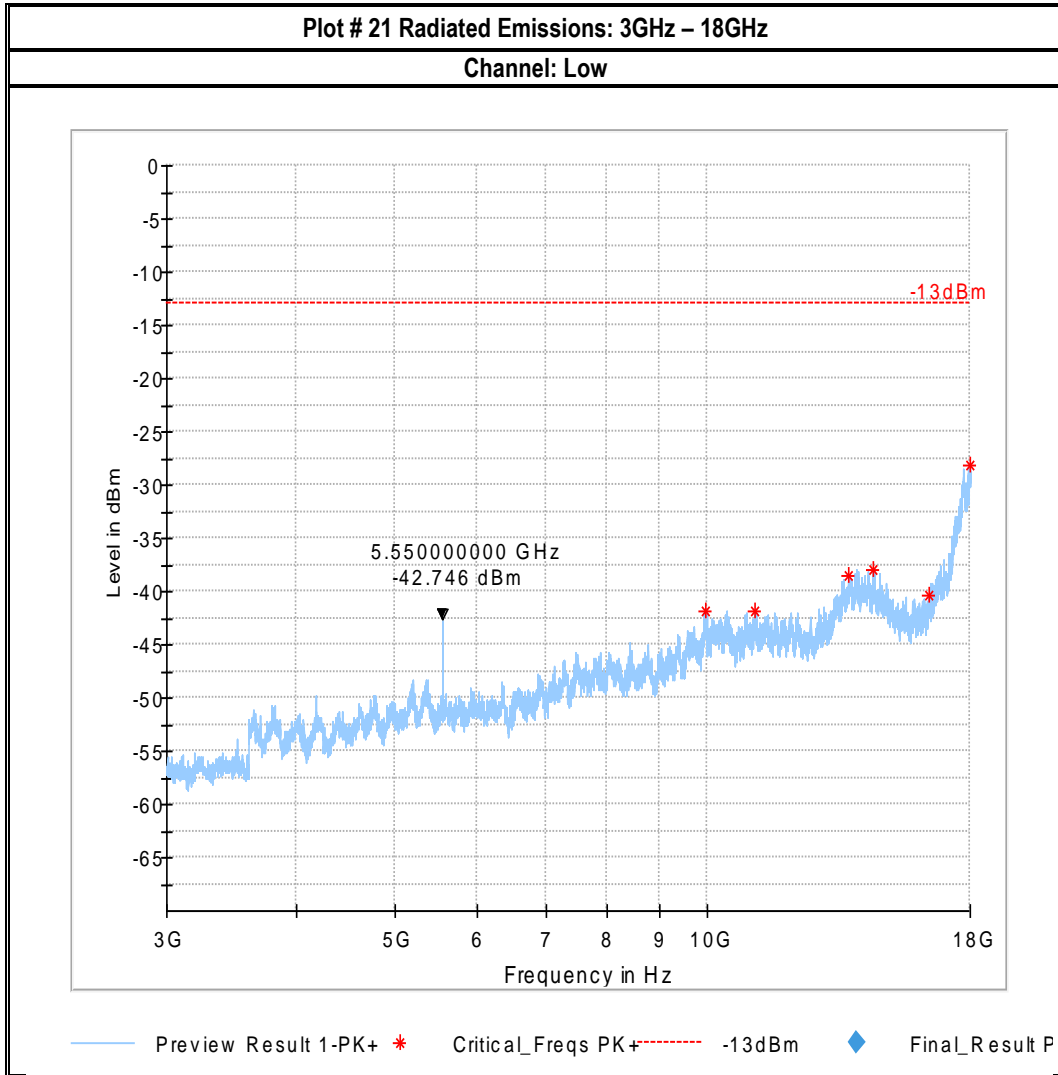


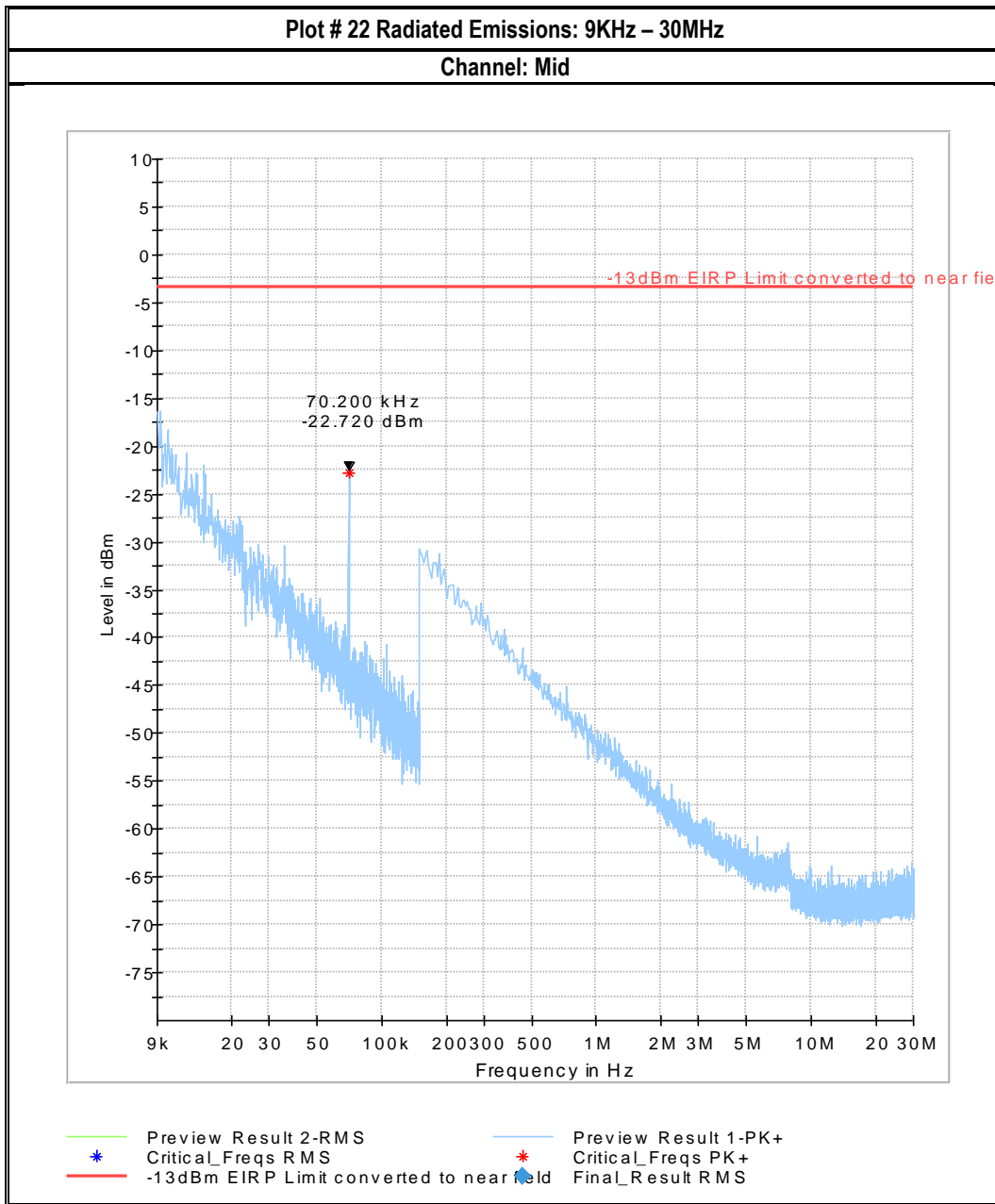
LTE 2

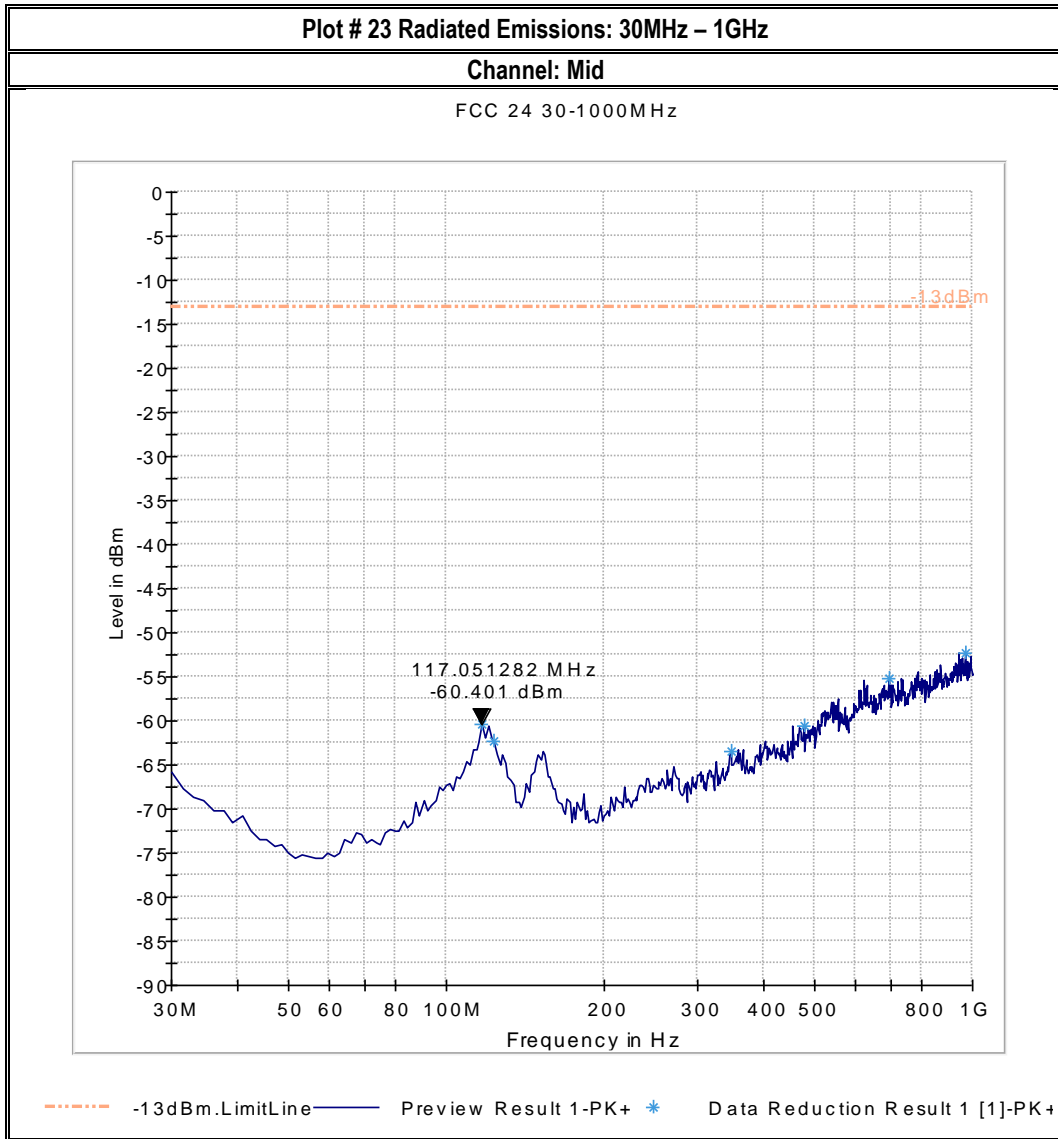


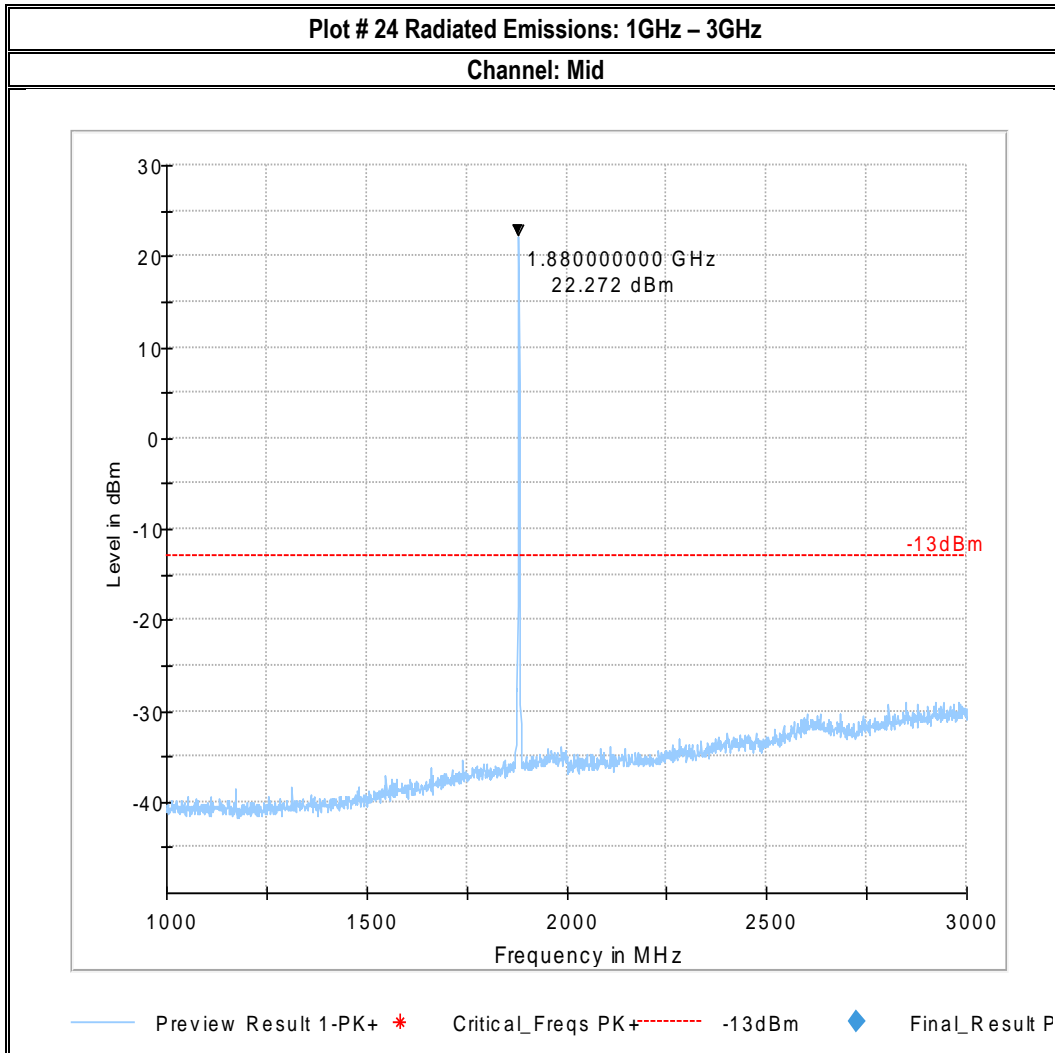


Note: The peak signal above is the transmit channel.

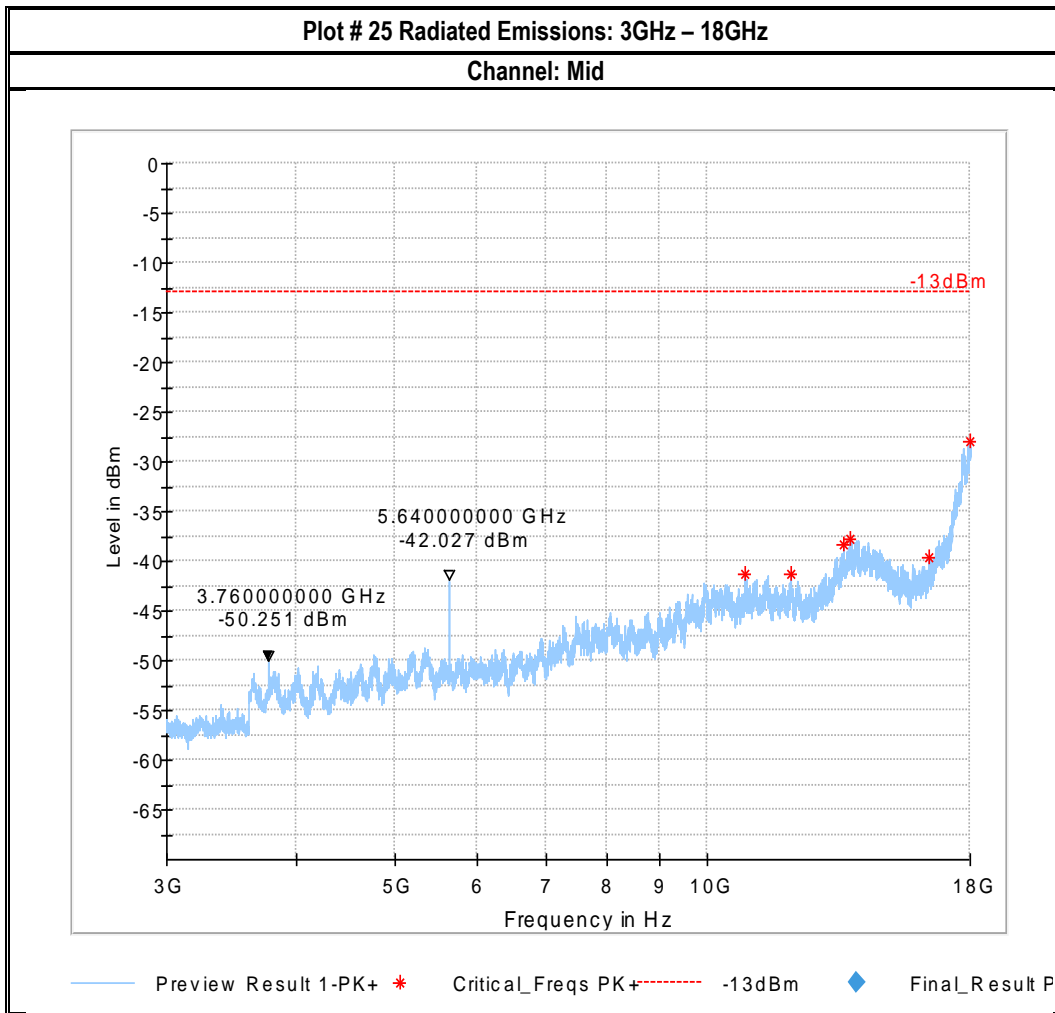








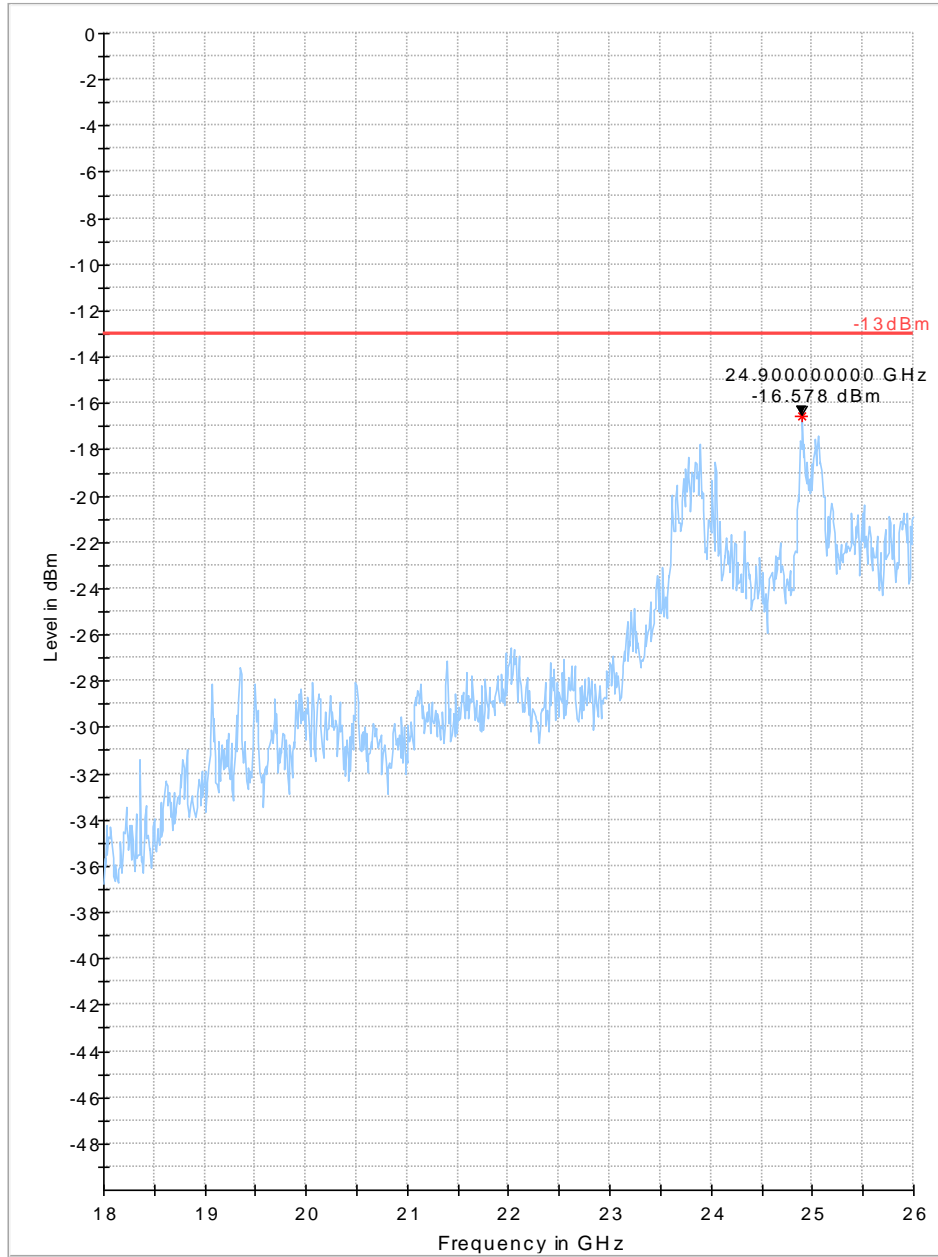
Note: The peak signal above is the transmit channel.



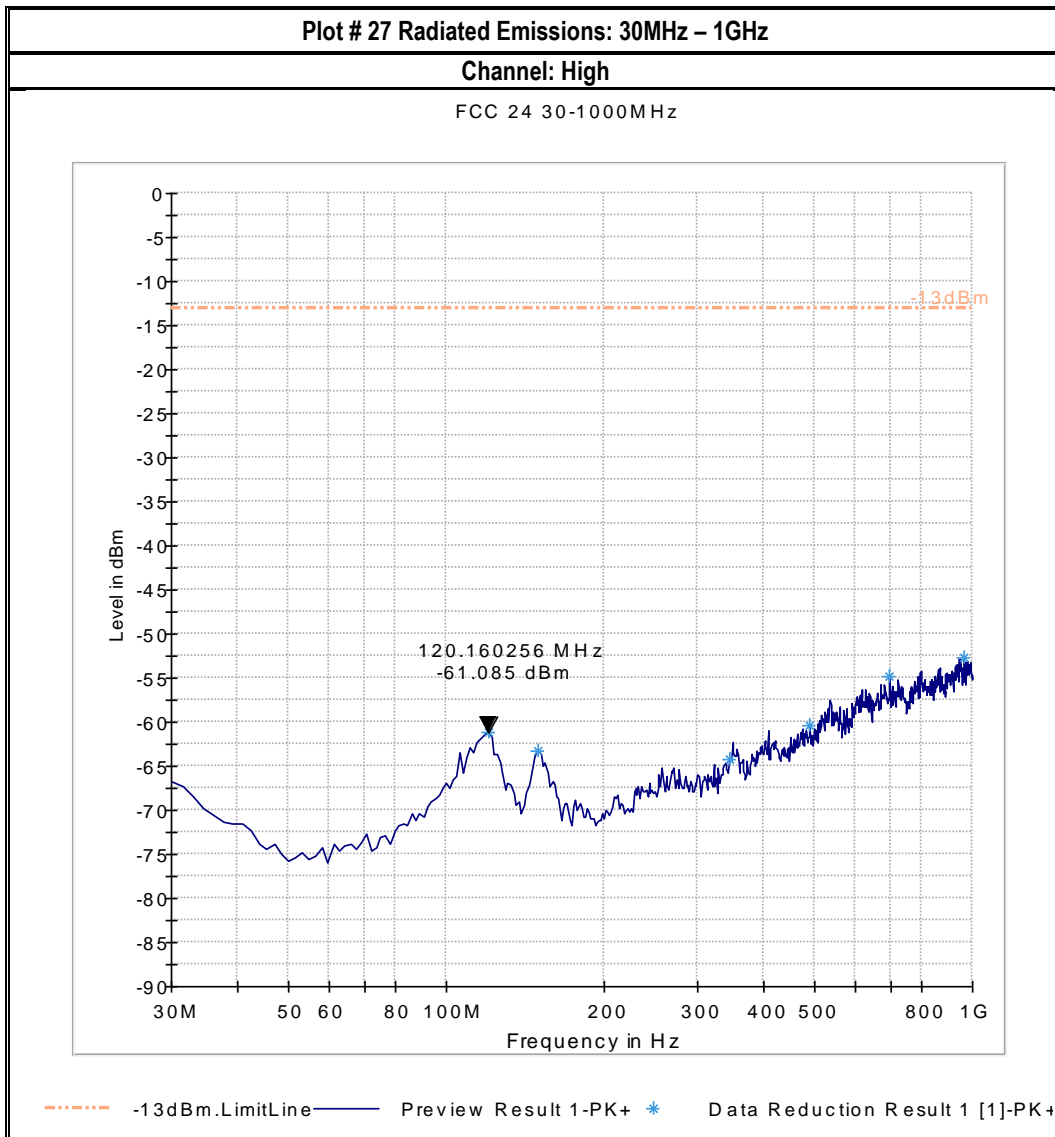


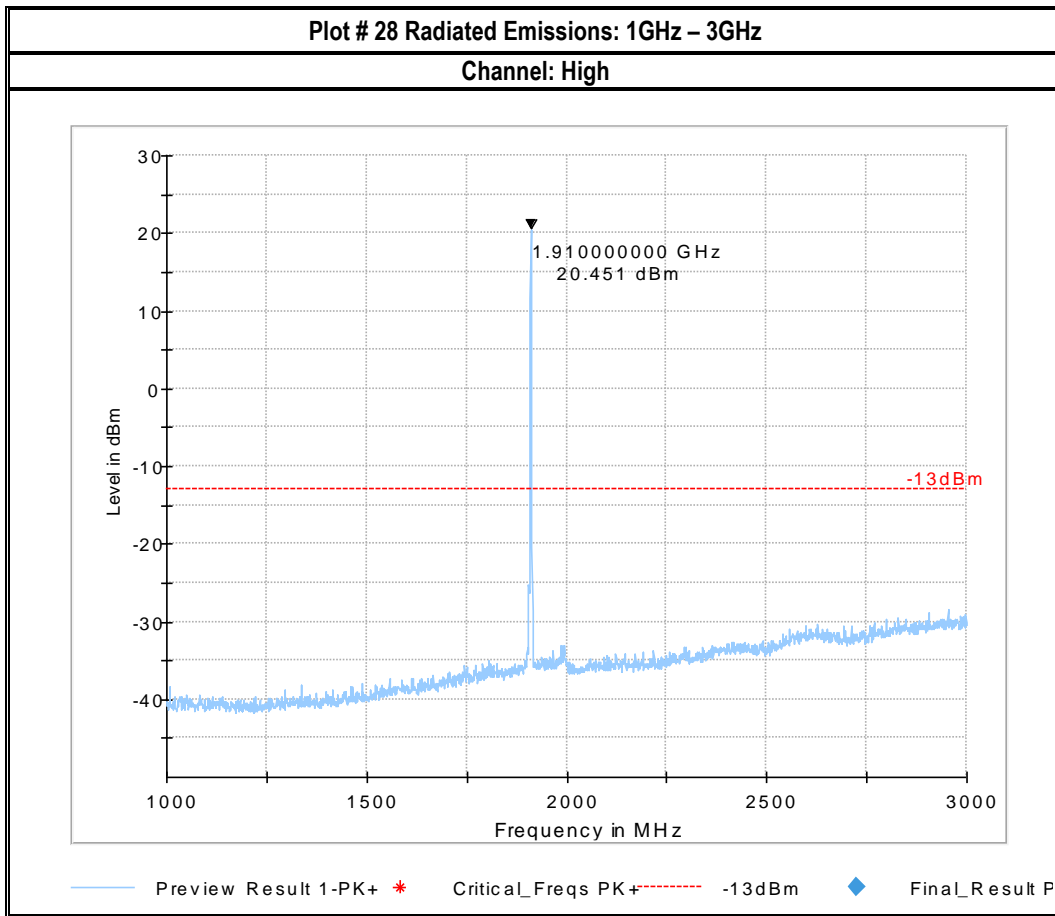
Plot # 26 Radiated Emissions: 18GHz – 26GHz

Channel: Mid

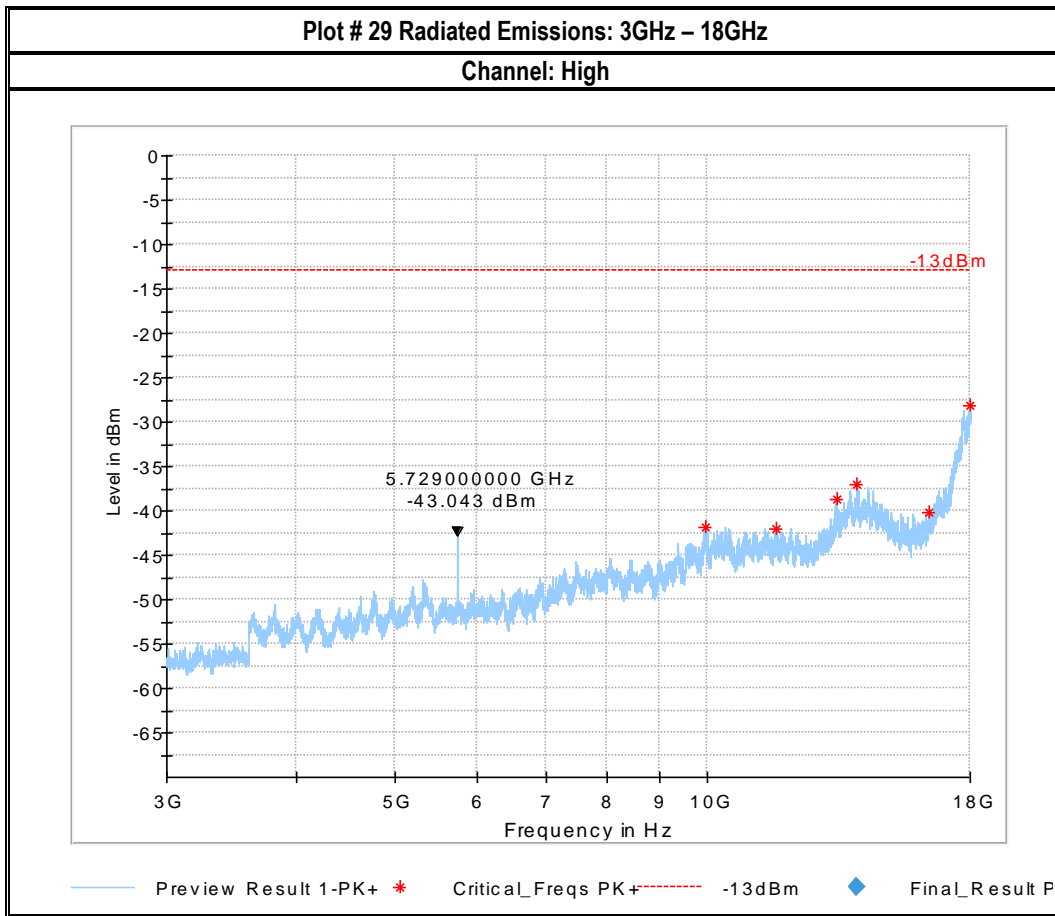


Preview Result 1-PK+ * Critical_Freqs PK+ -13dBm Final_Result P



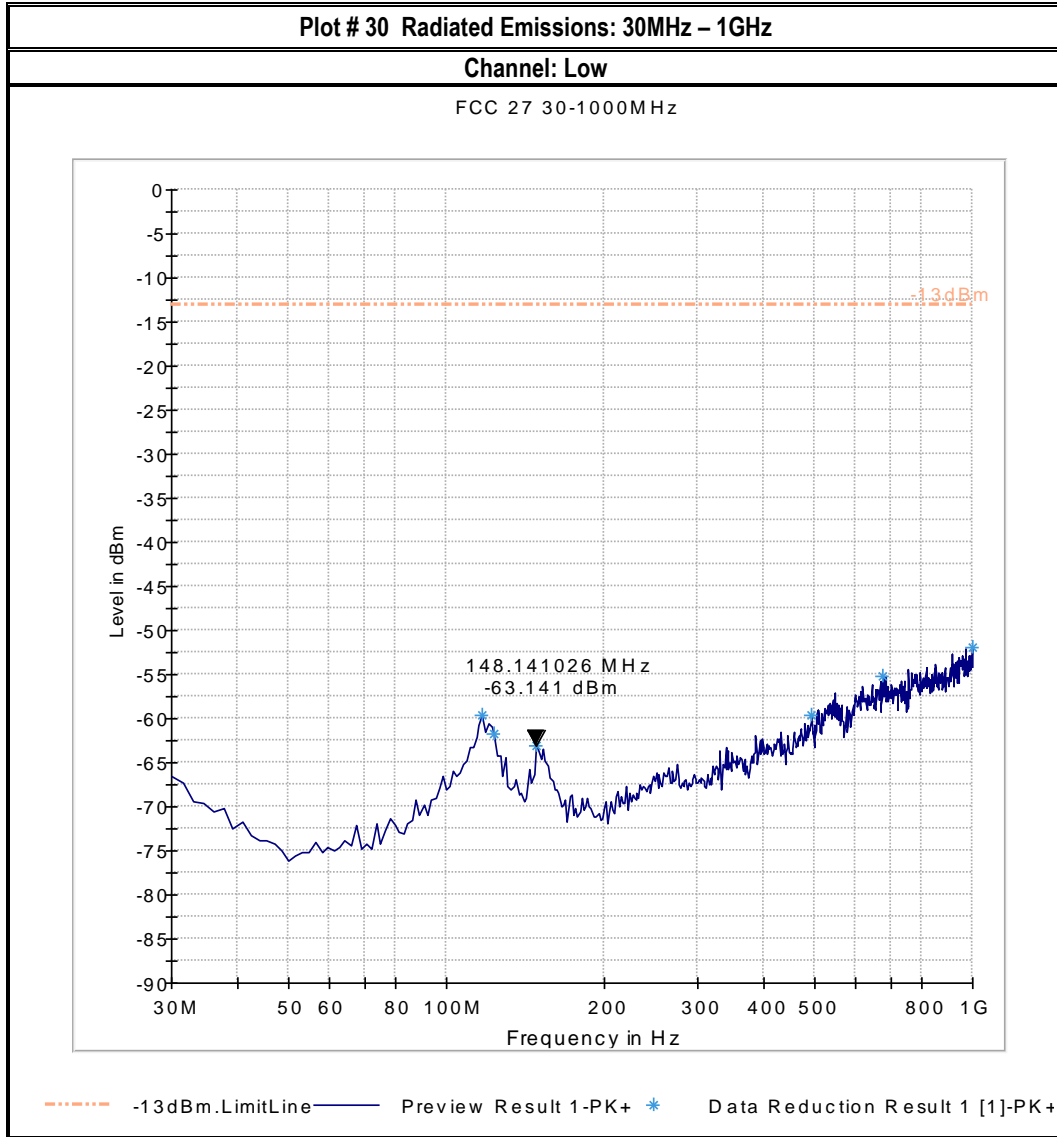


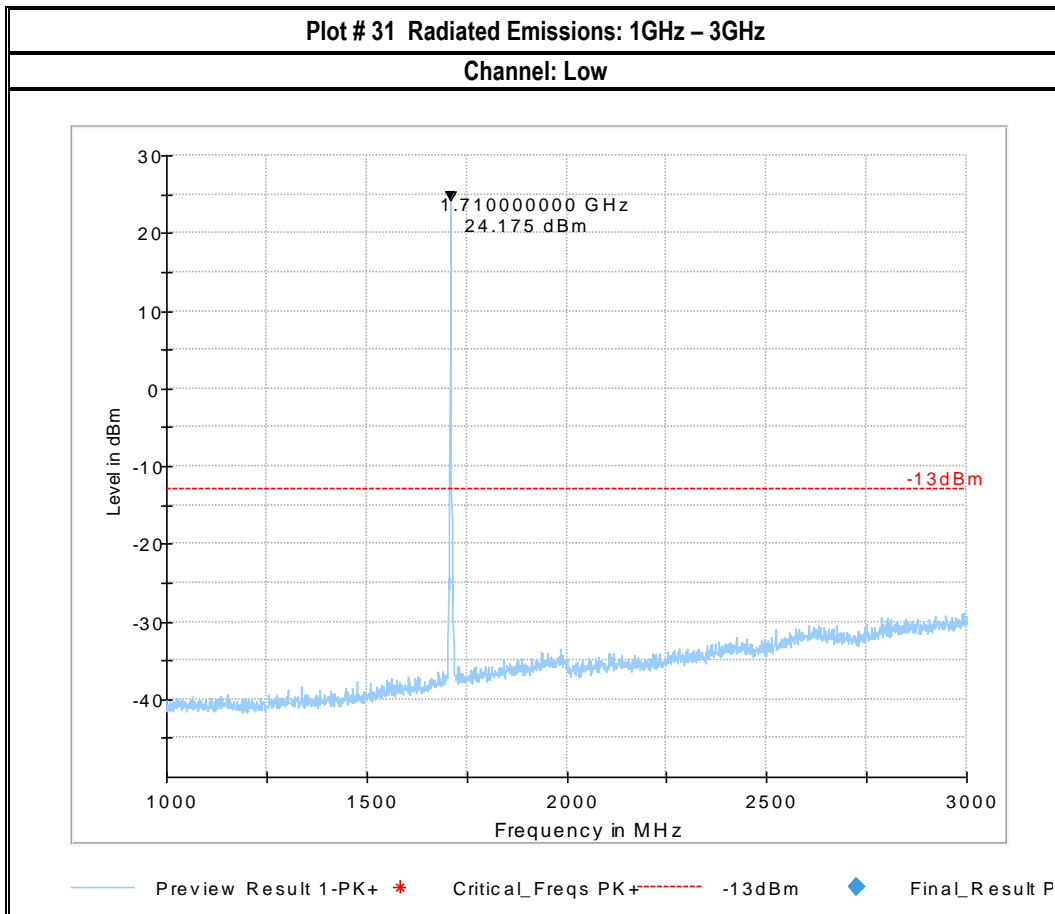
Note: The peak signal above is the transmit channel.



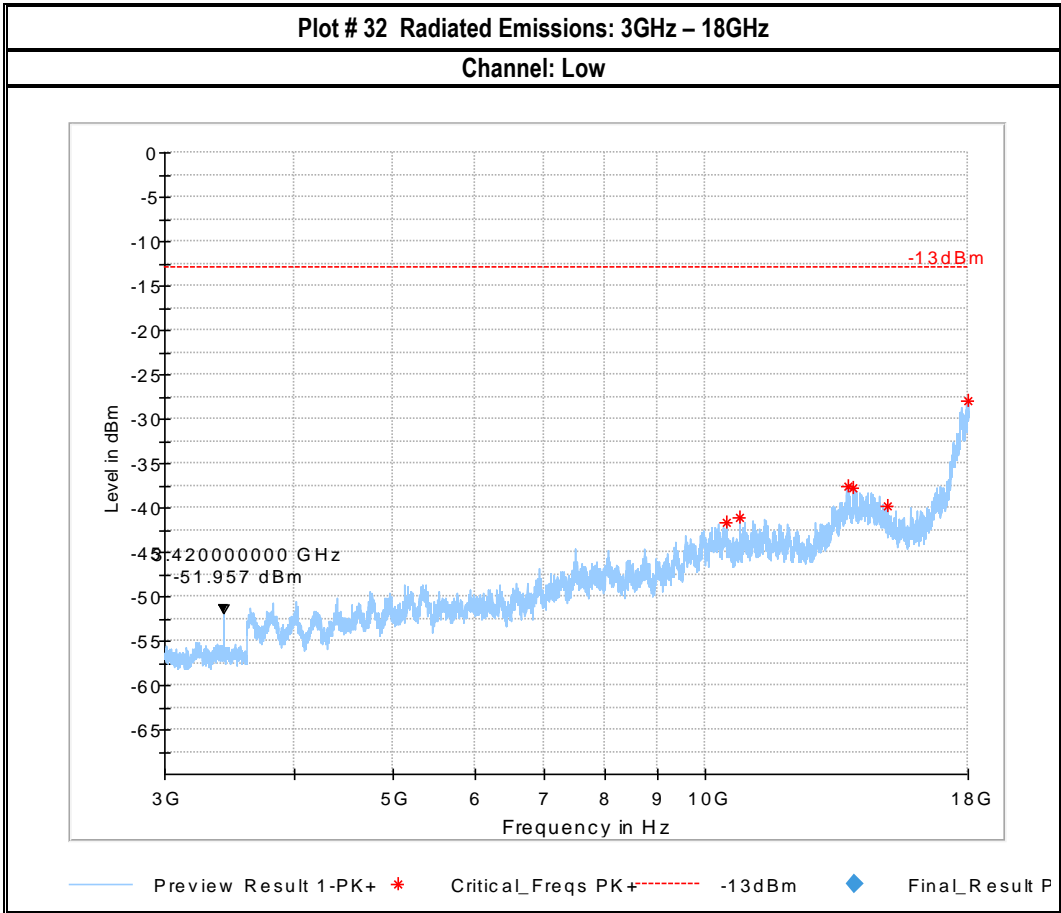


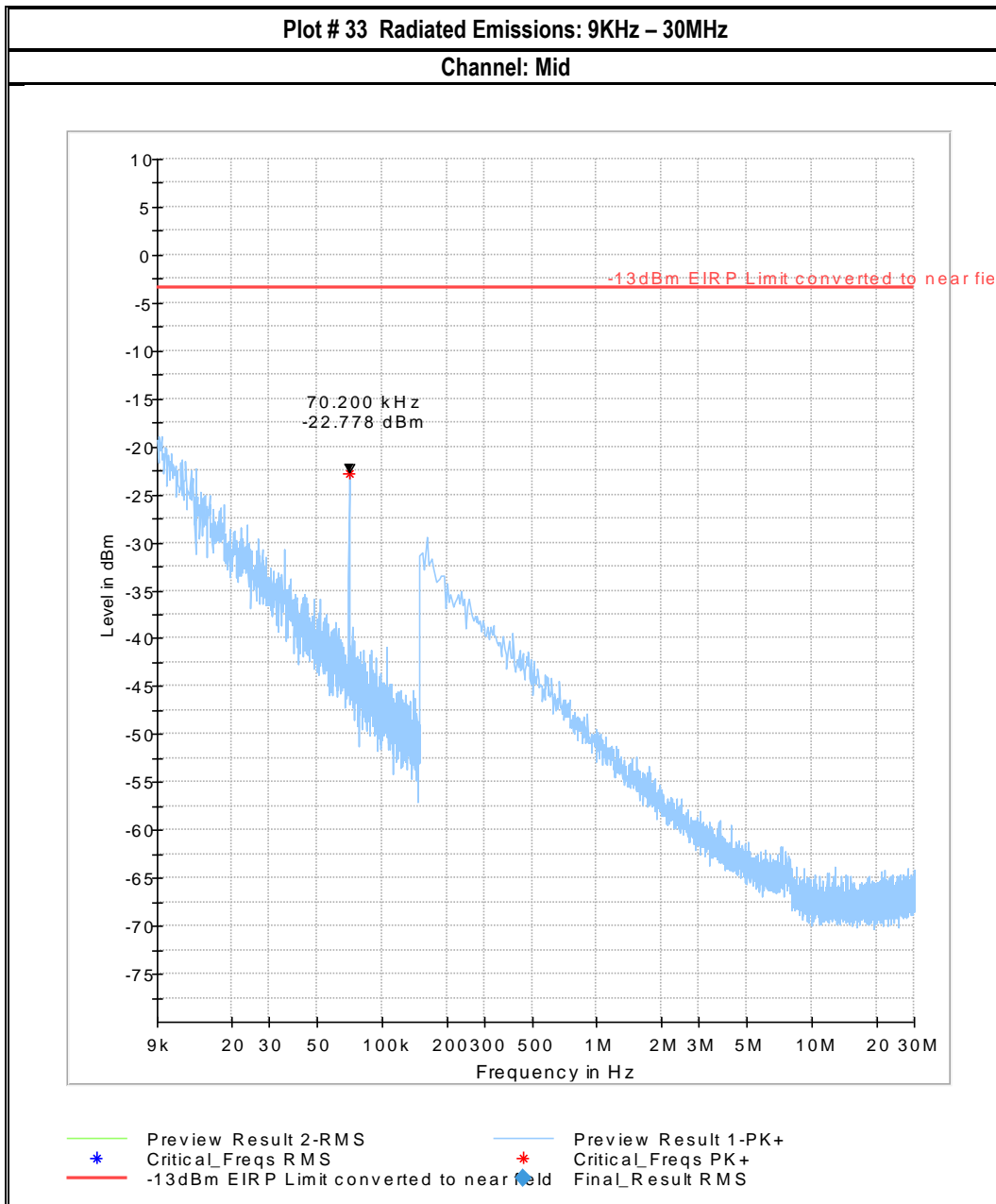
LTE 4

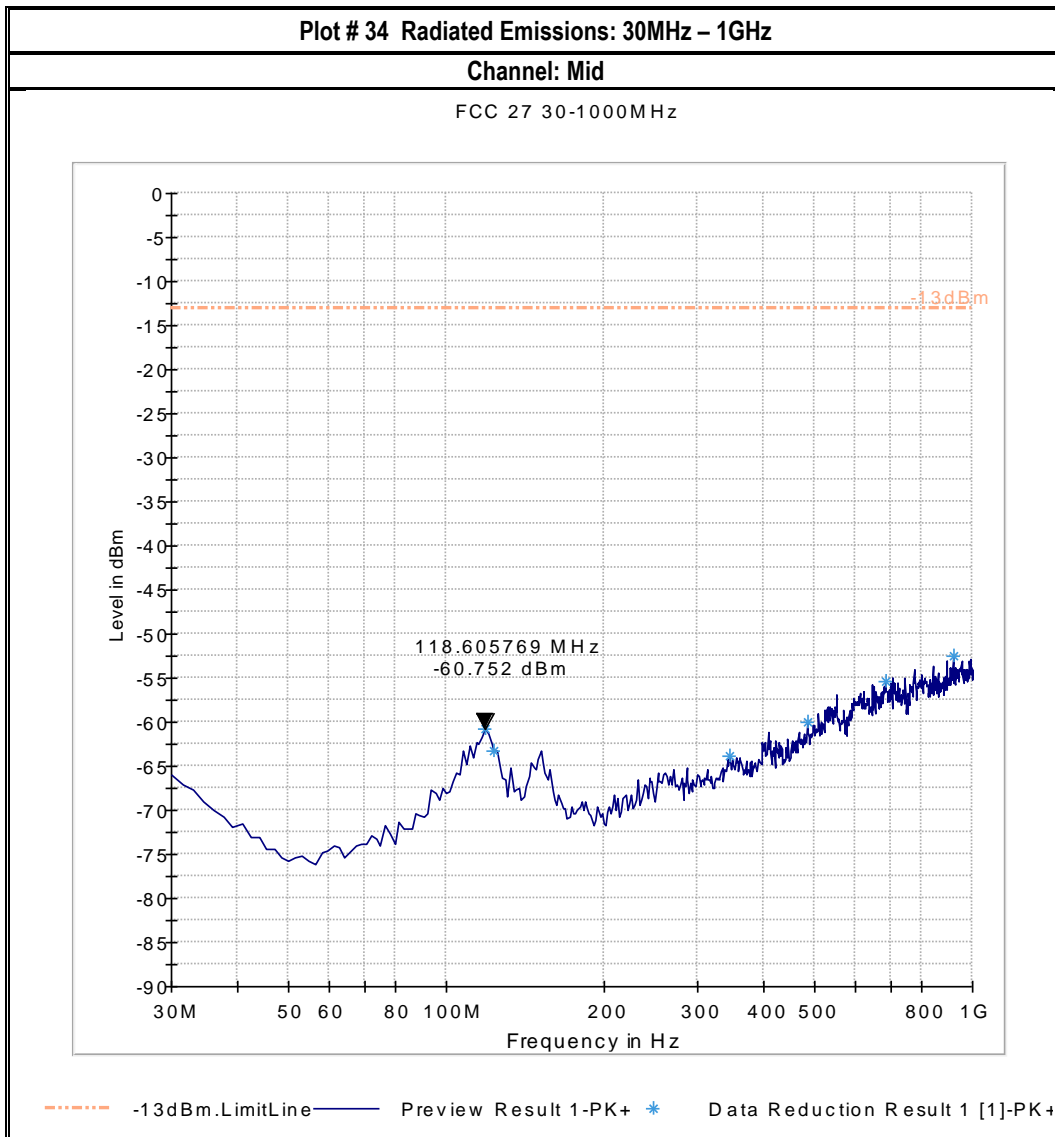


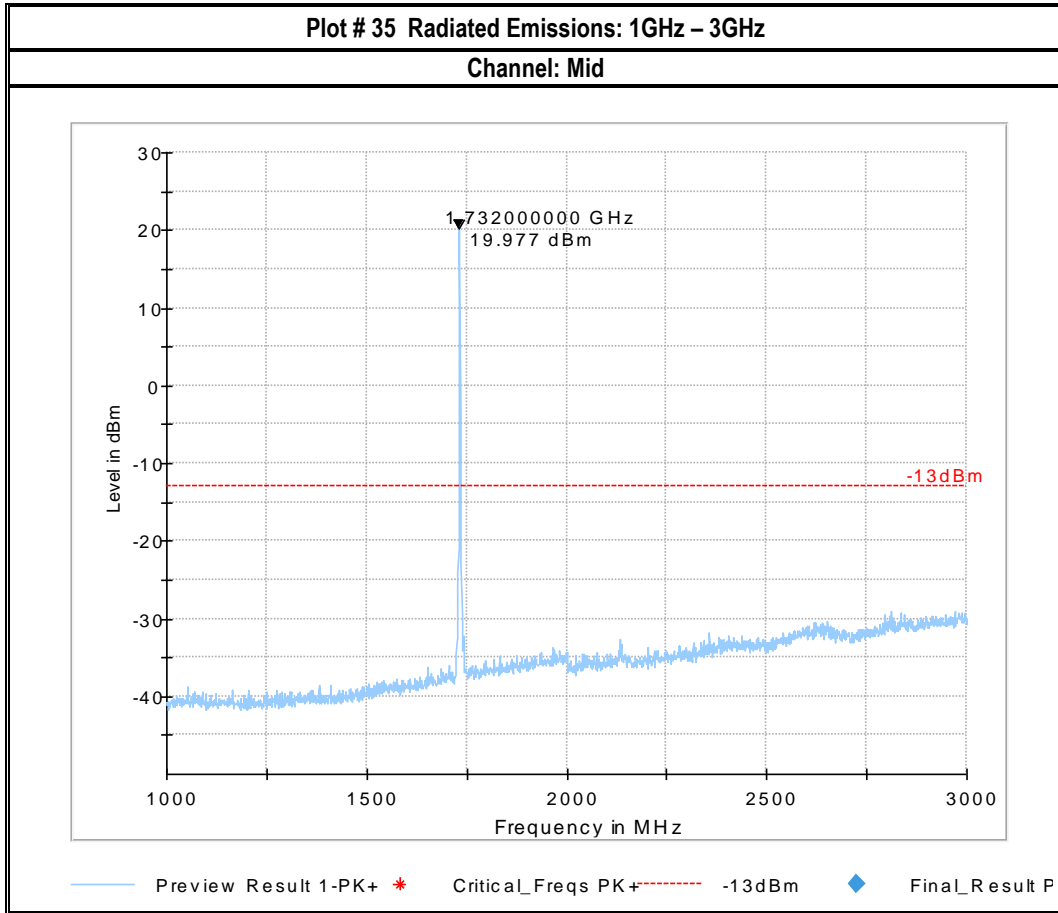


Note: The peak signal above is the transmit channel.

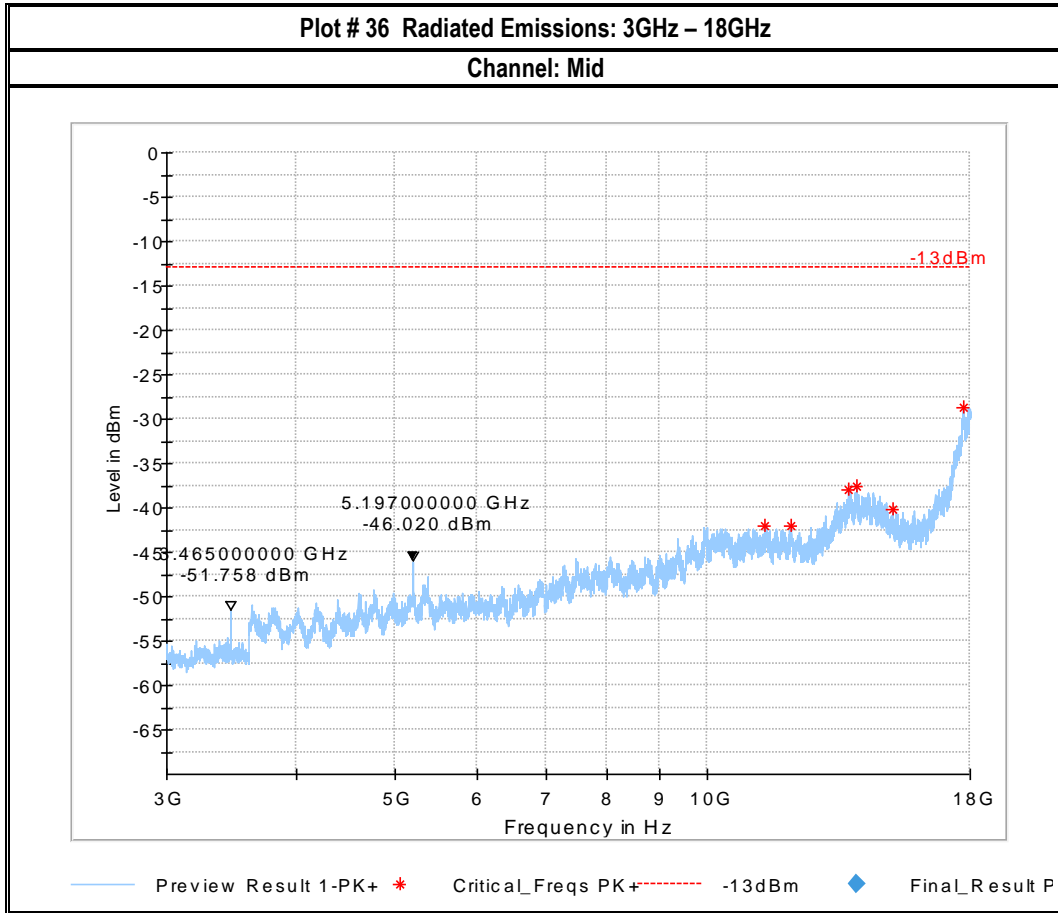


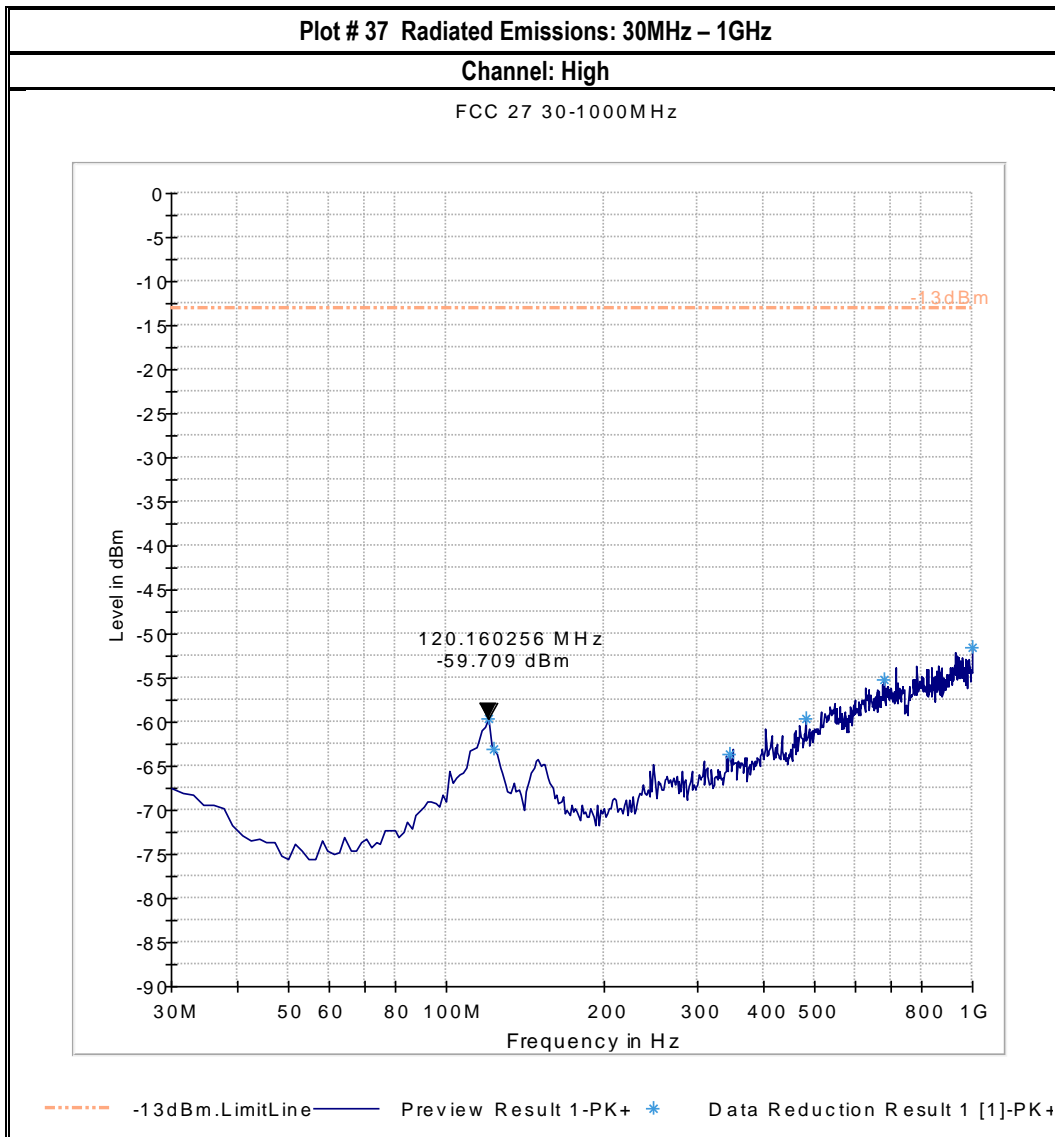


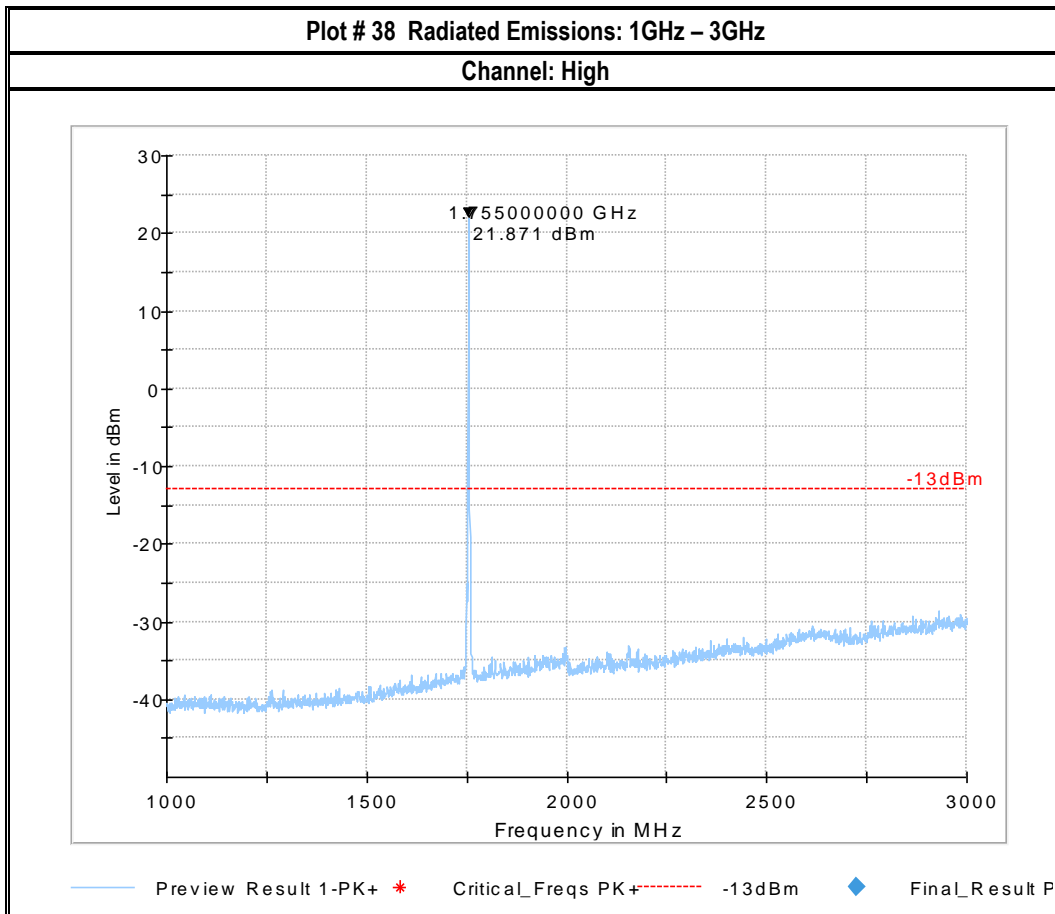




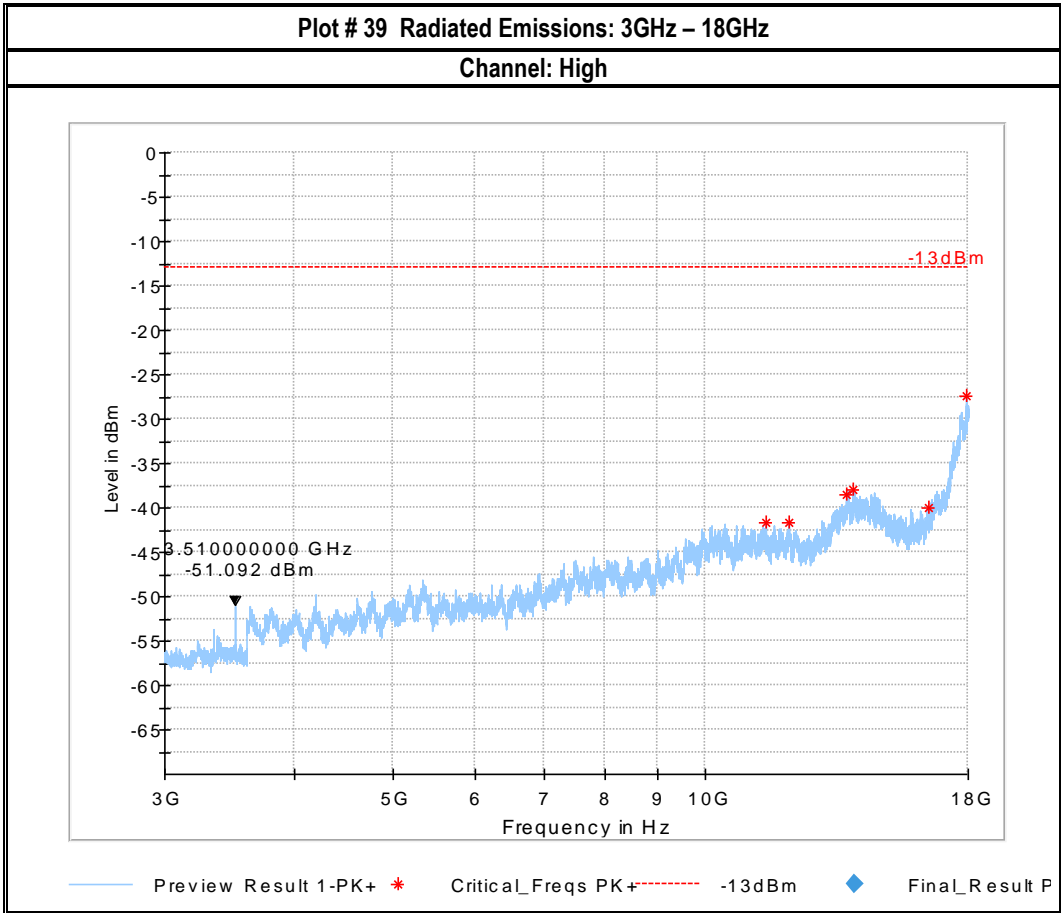
Note: The peak signal above is the transmit channel.





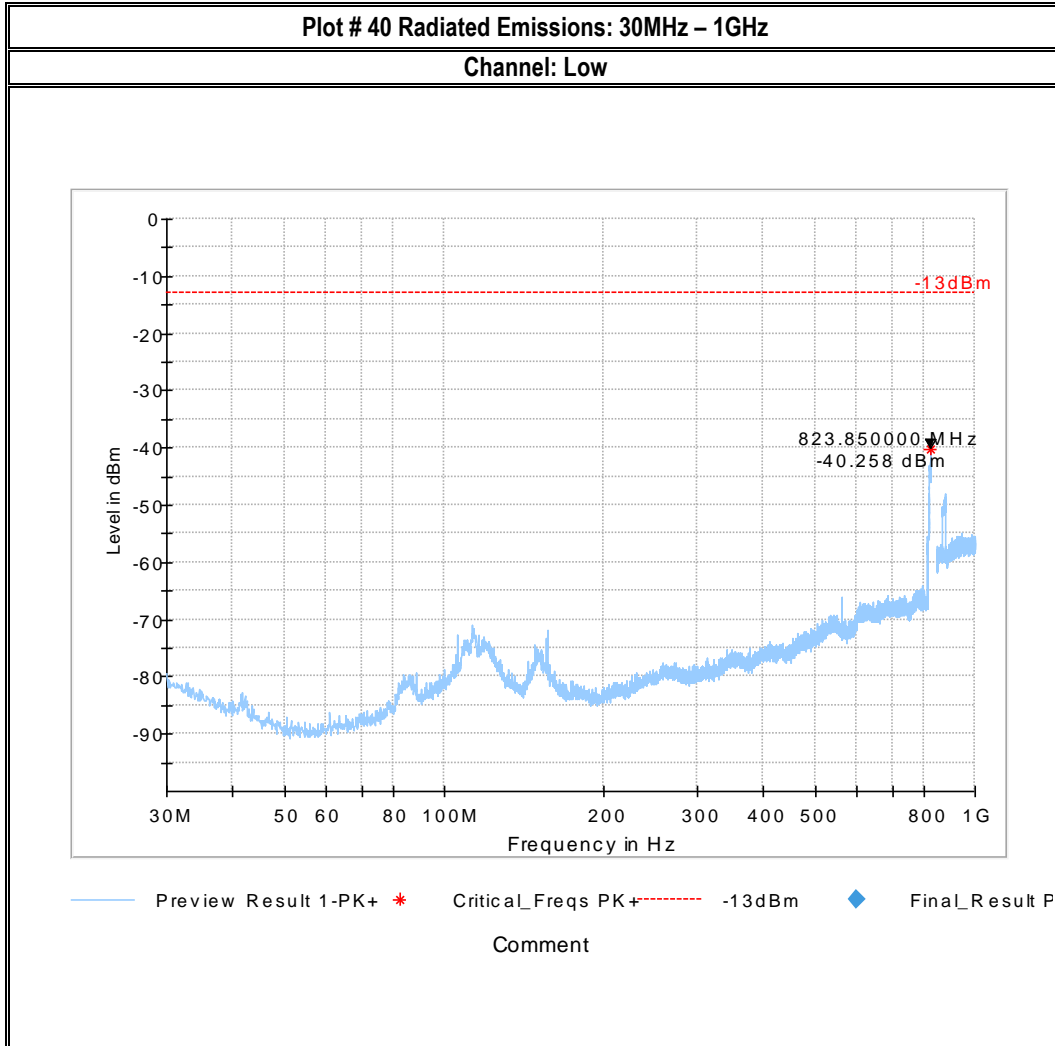


Note: The peak signal above is the transmit channel.





LTE 5

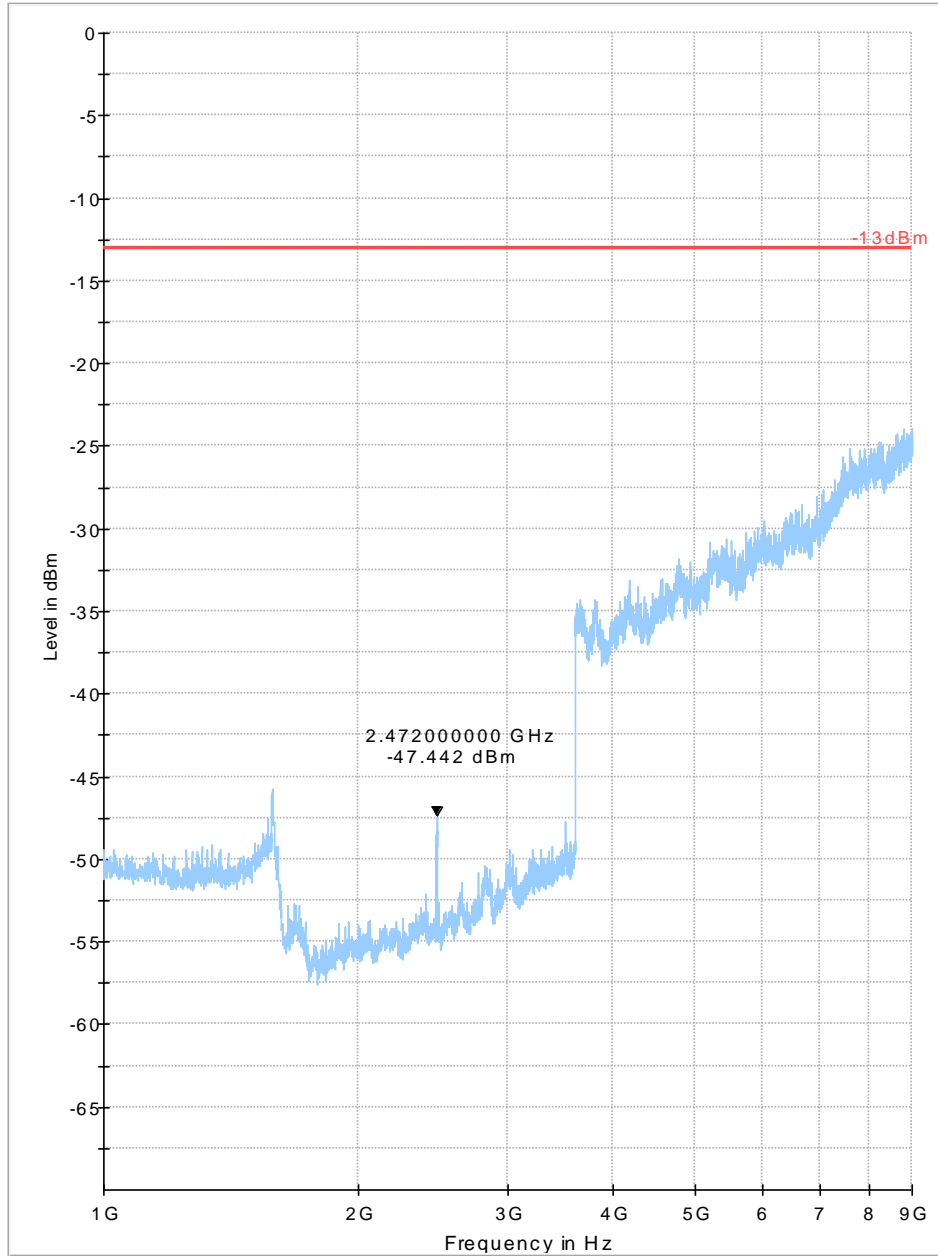


Note: The peak signal above is the transmit channel.

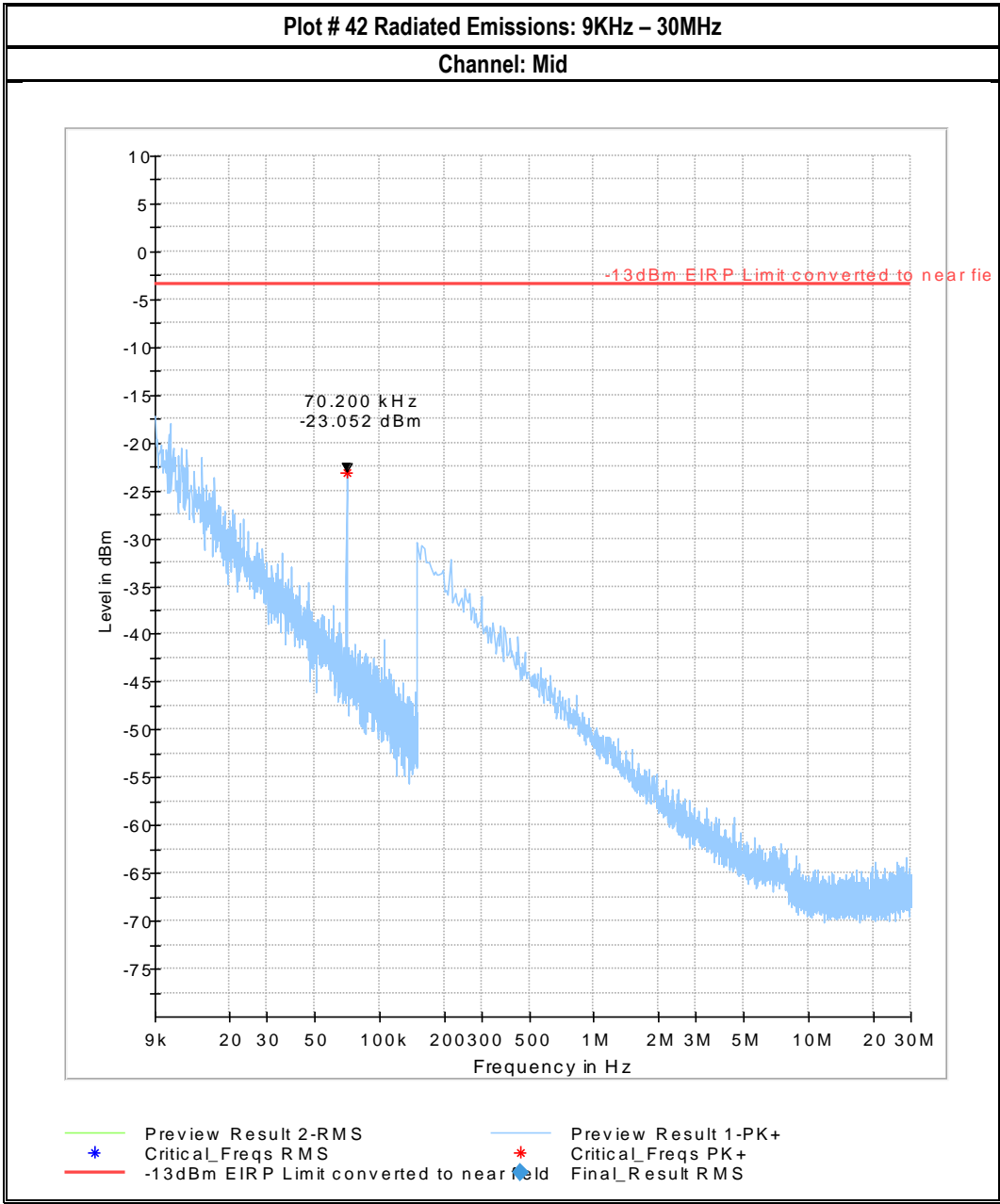


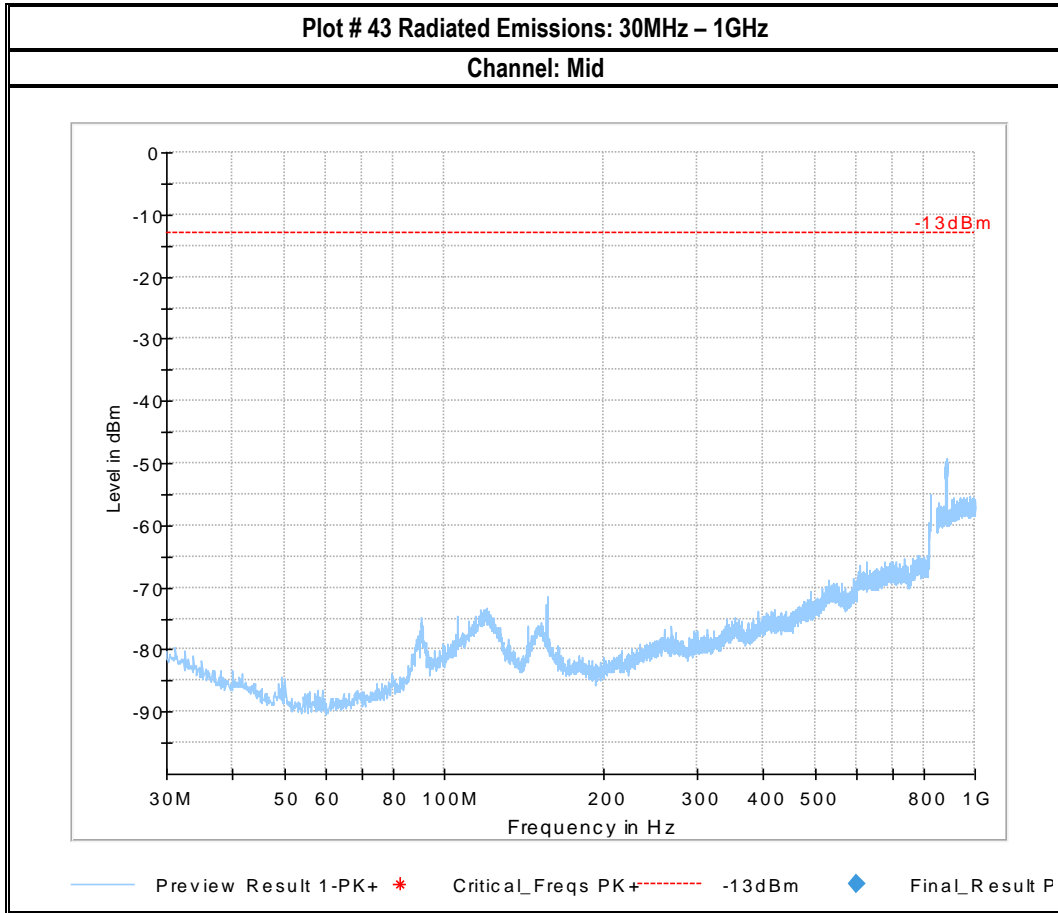
Plot # 41 Radiated Emissions: 1GHz – 9GHz

Channel: Low

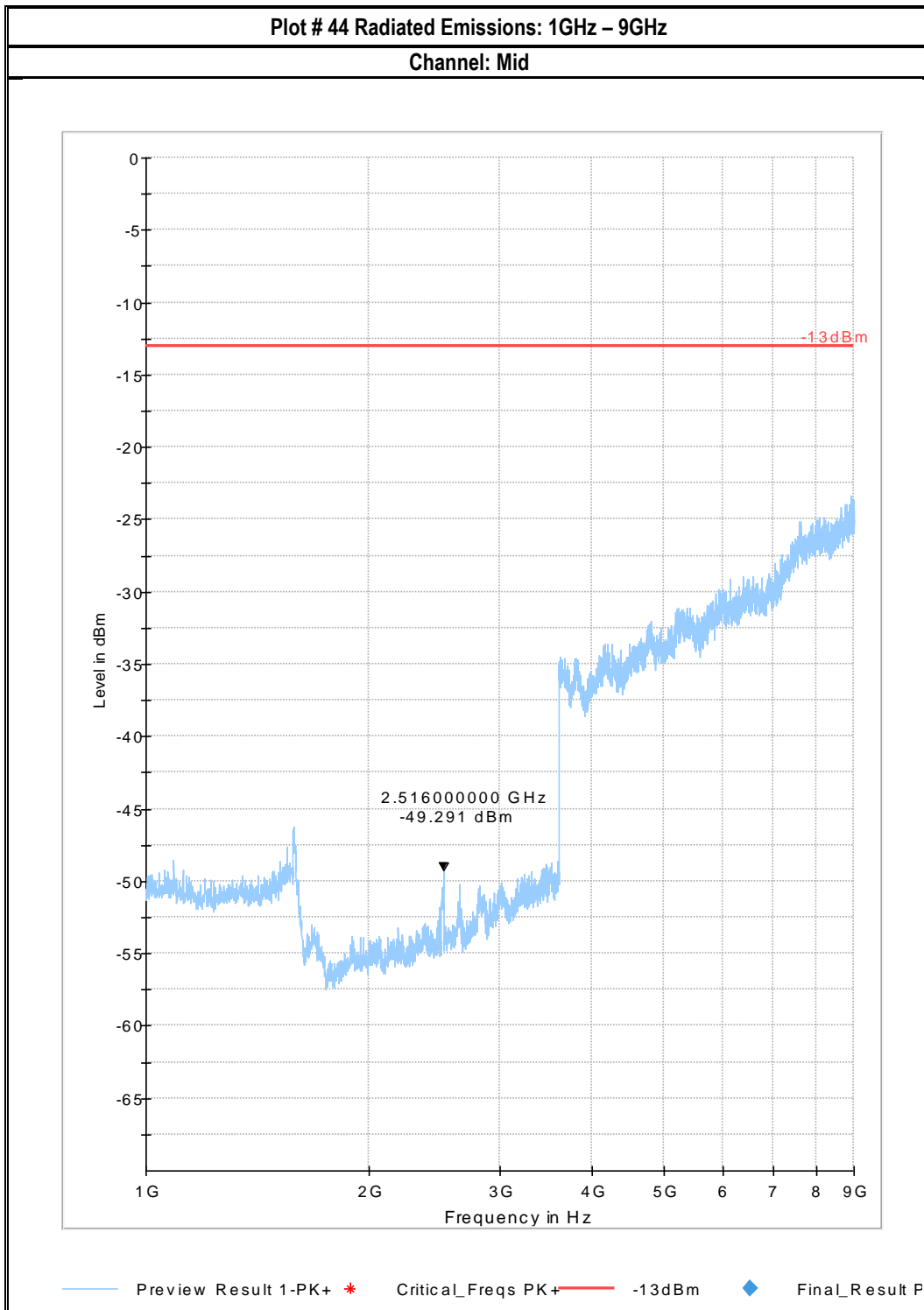


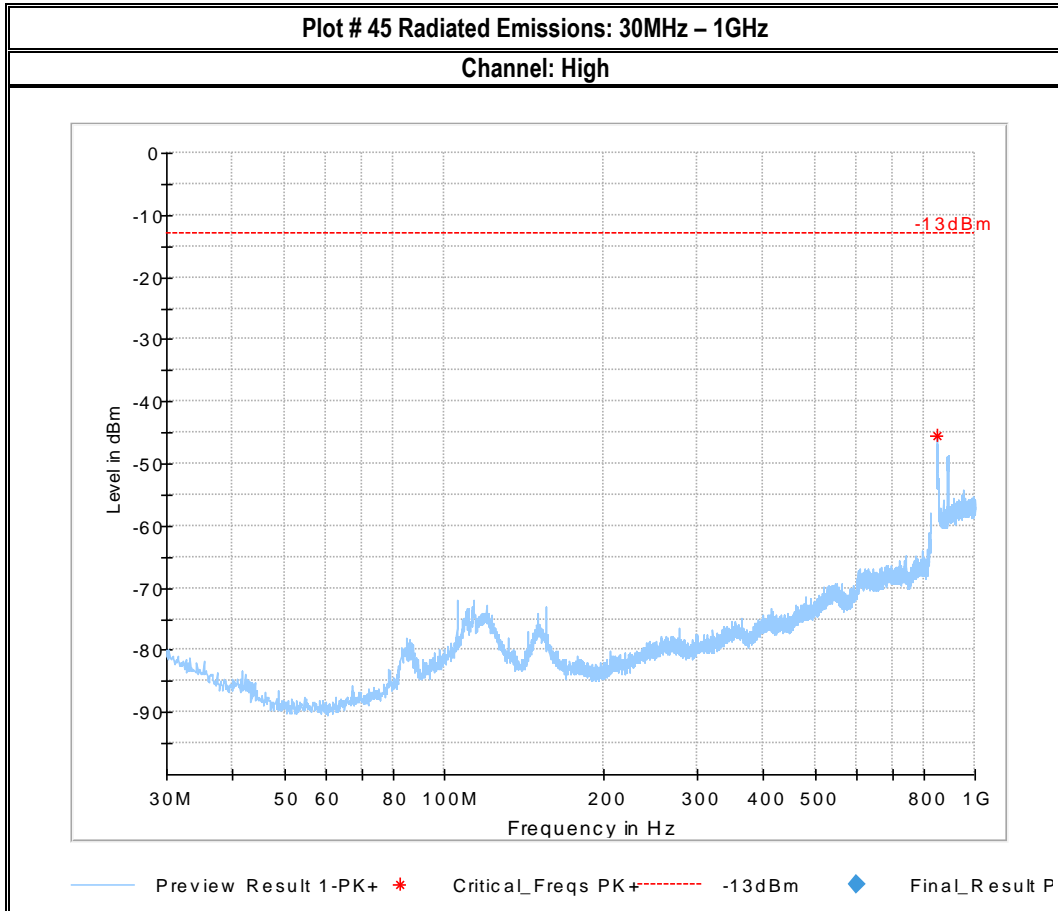
Preview Result 1-PK+ * Critical_Freqs PK+ -13dBm Final_Result P



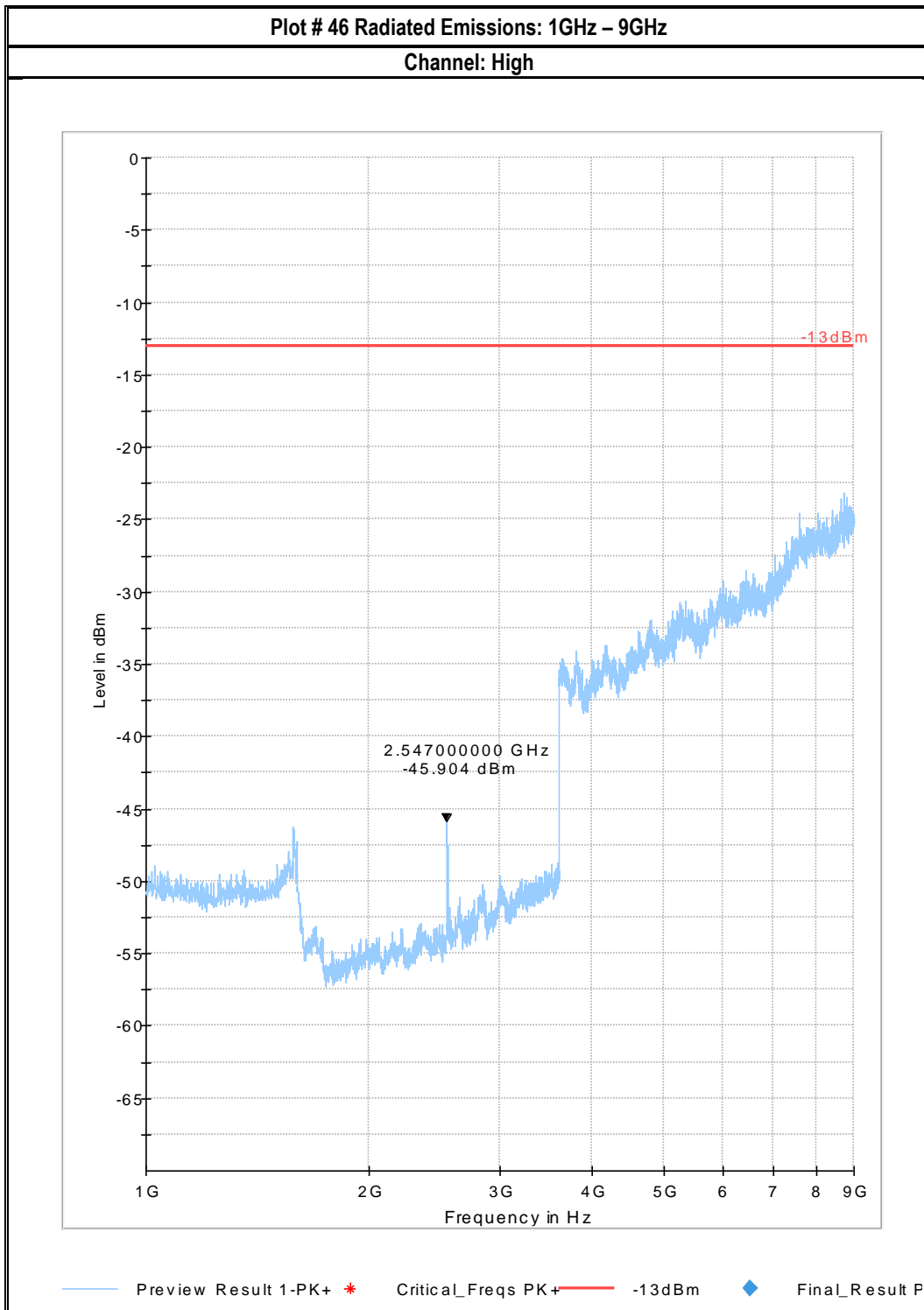


Note: The peak signal above is the transmit channel.



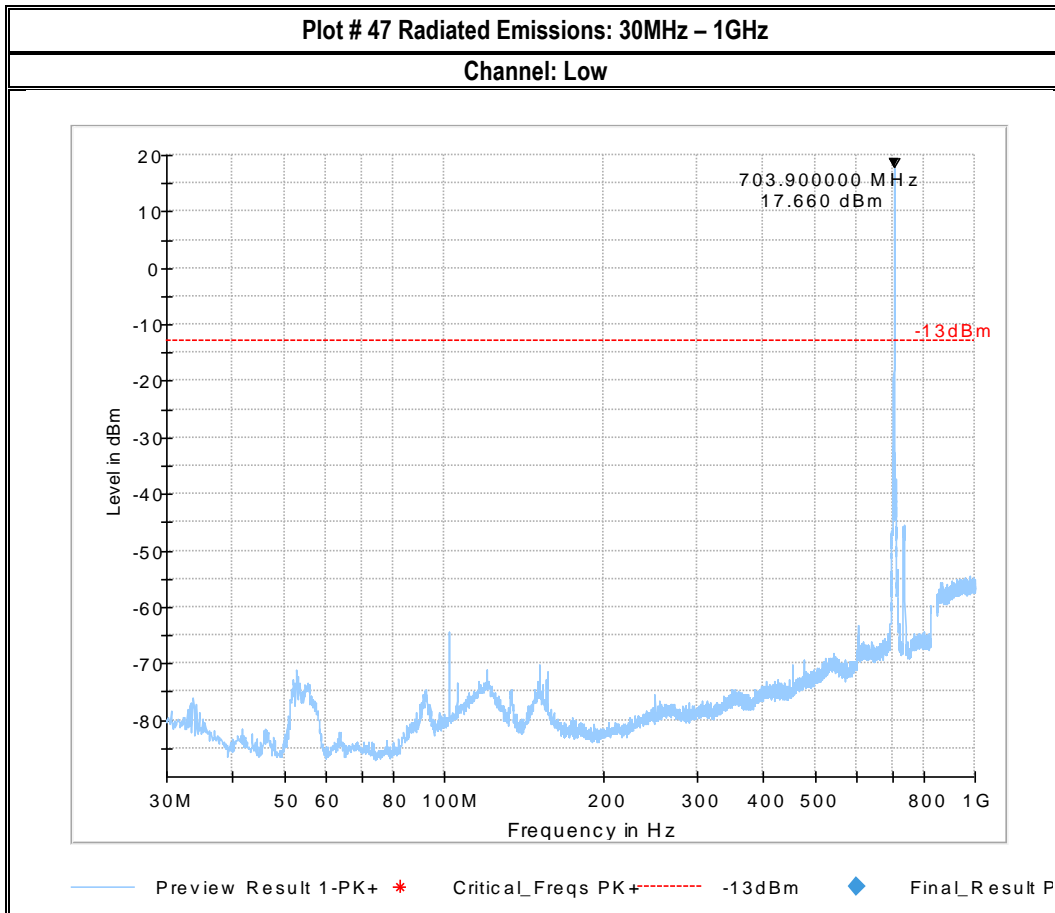


Note: The peak signal above is the transmit channel.

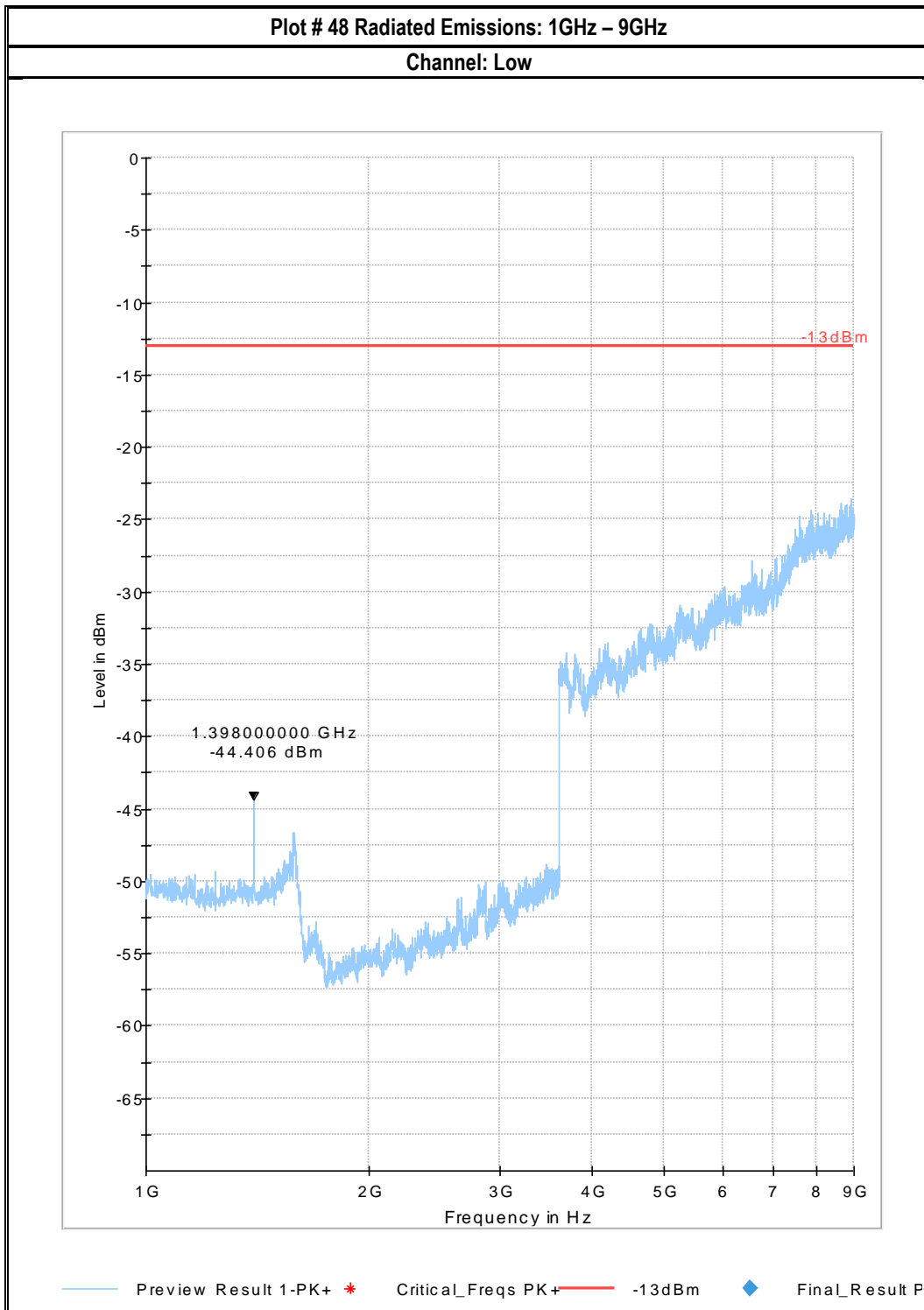


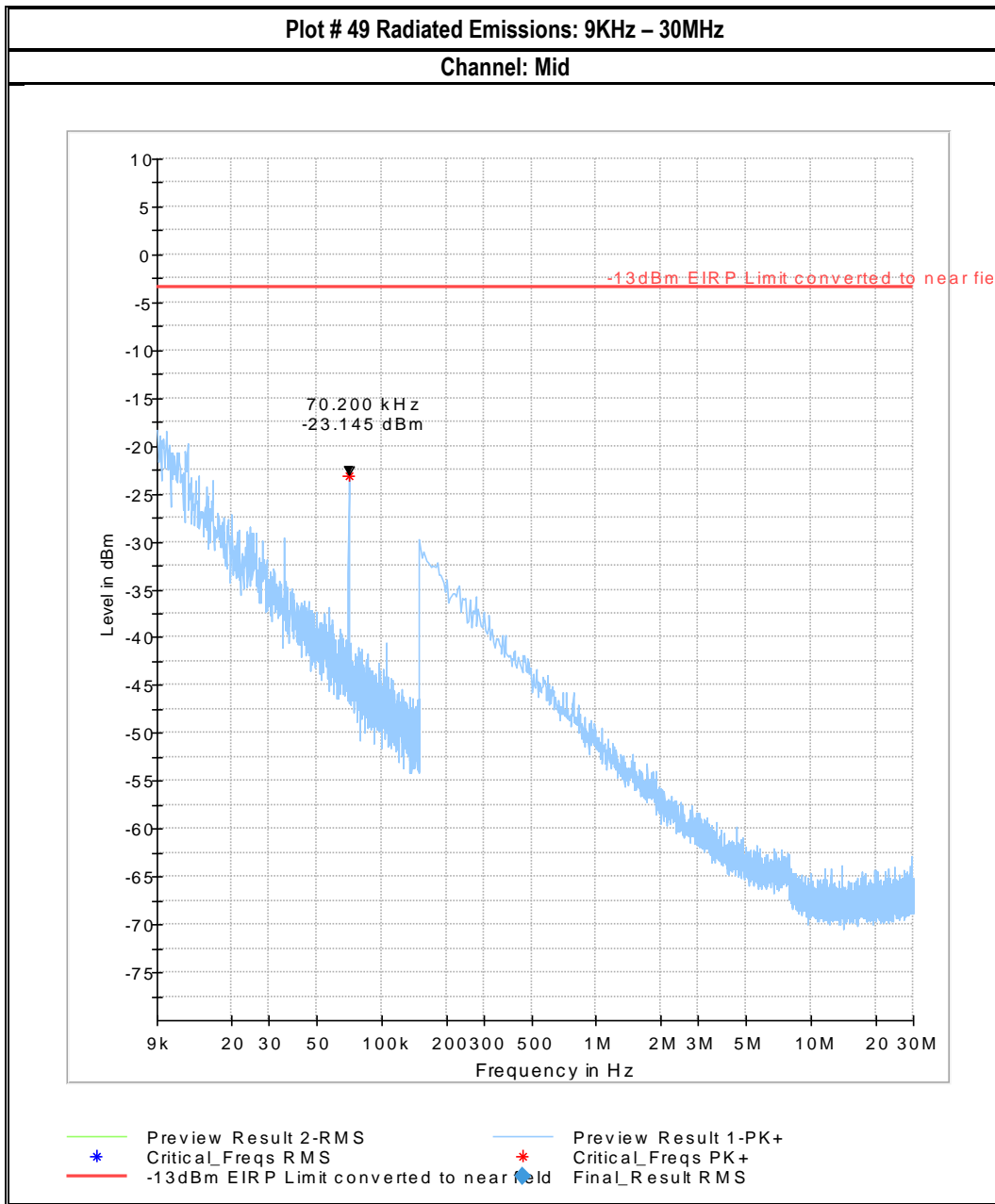


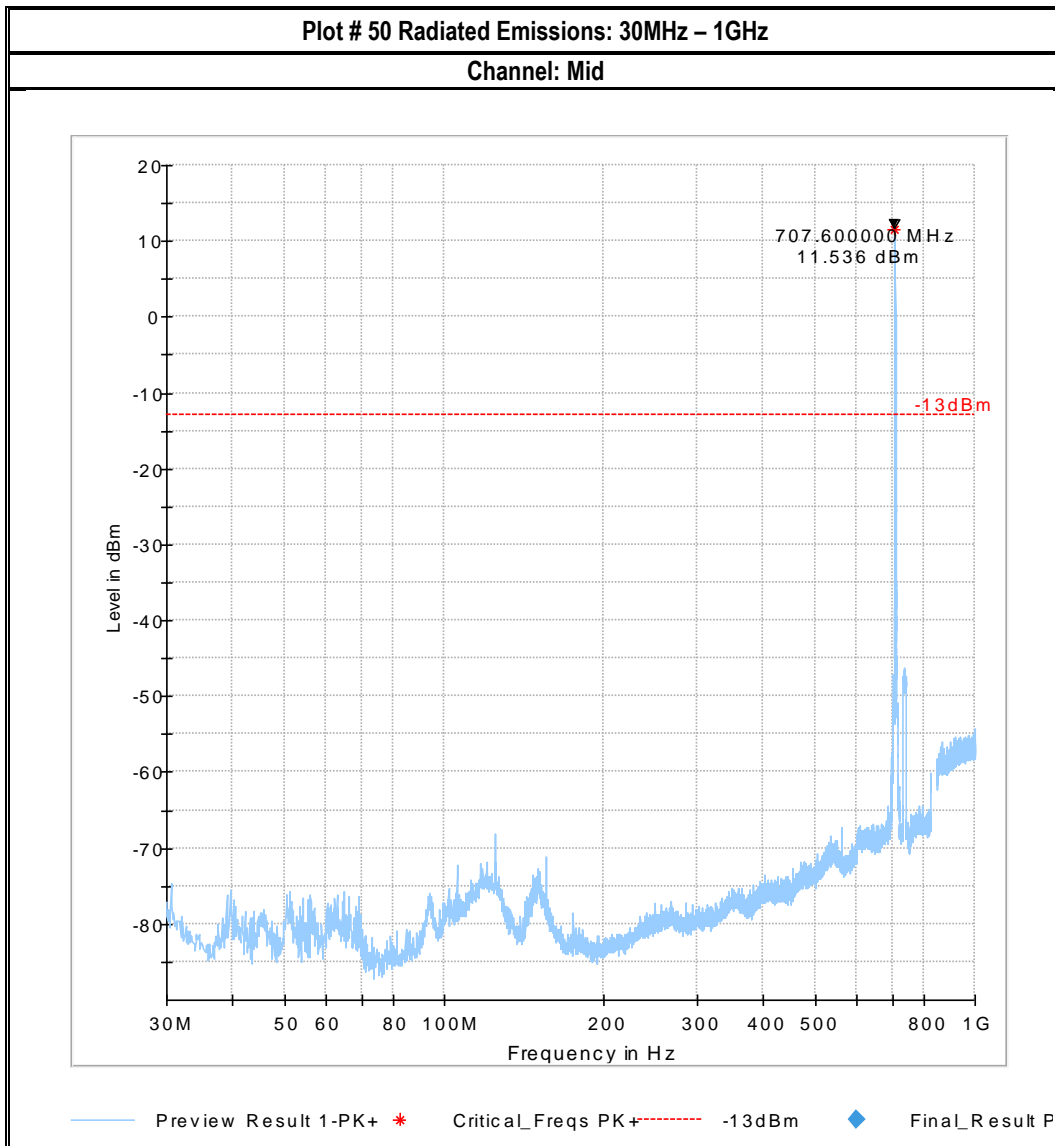
LTE 12



Note: The peak signal above is the transmit channel.





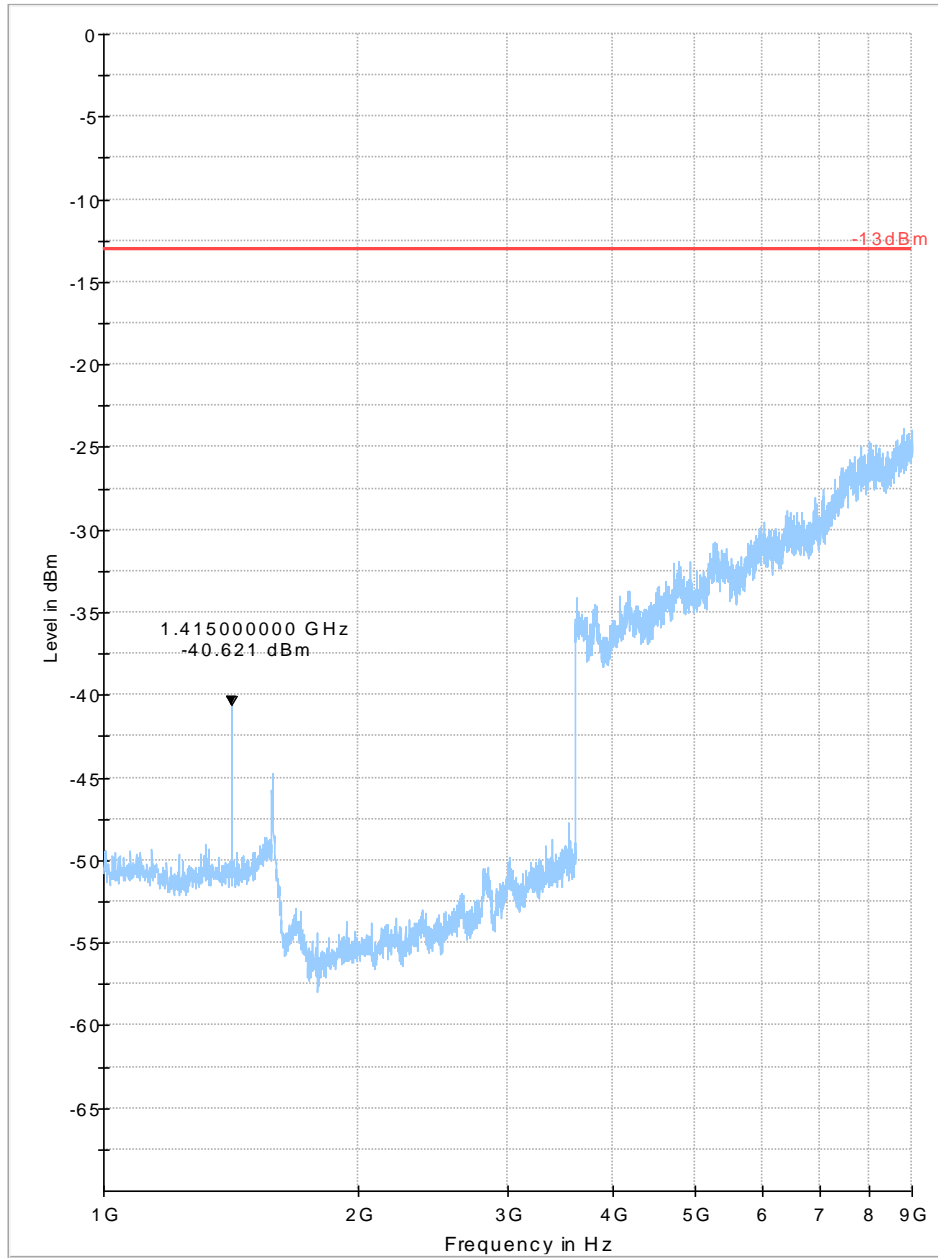


Note: The peak signal above is the transmit channel.

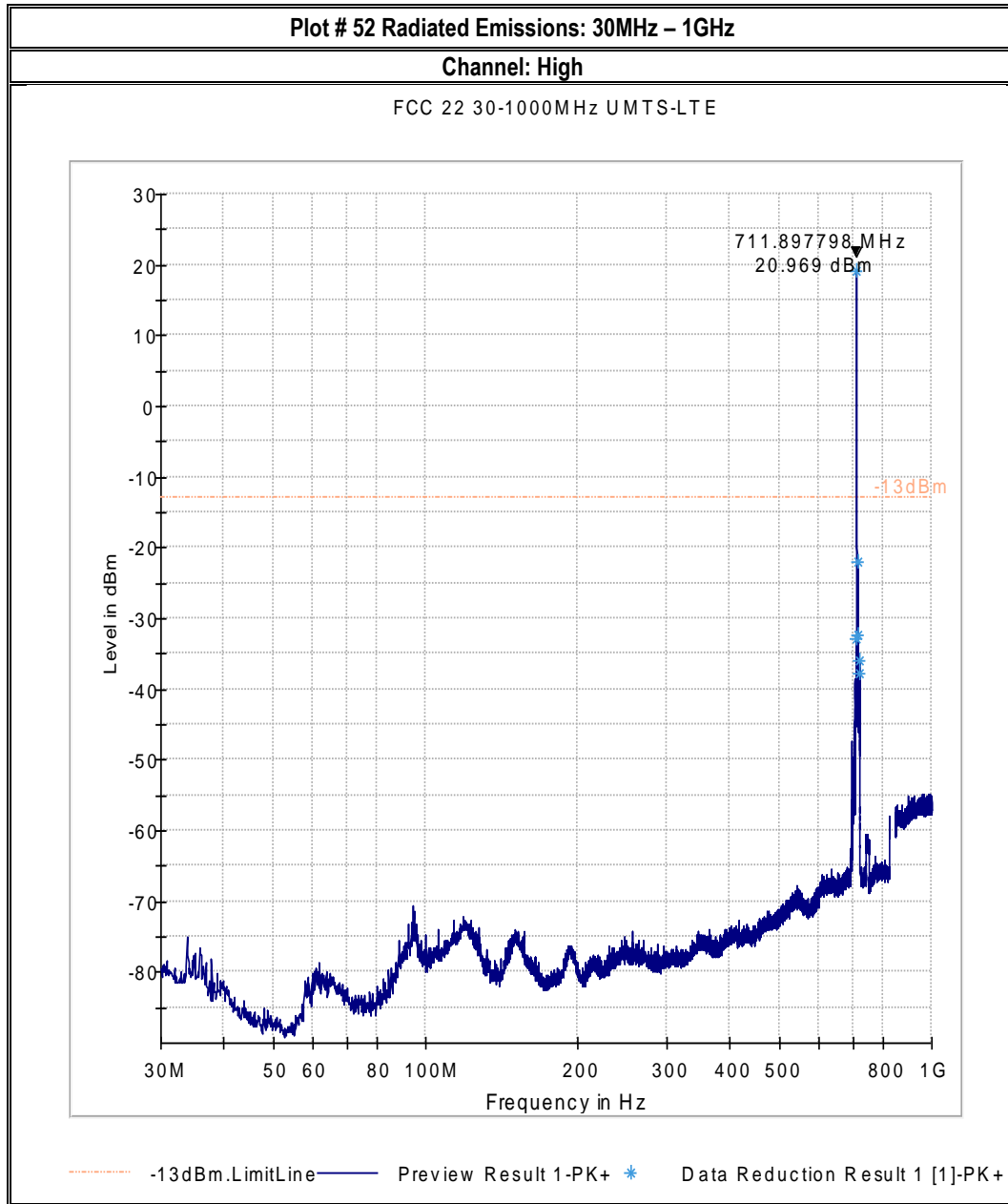


Plot # 51 Radiated Emissions: 1GHz – 9GHz

Channel: Mid



Preview Result 1-PK+ * Critical_Freqs PK+ -13dBm Final_Result P

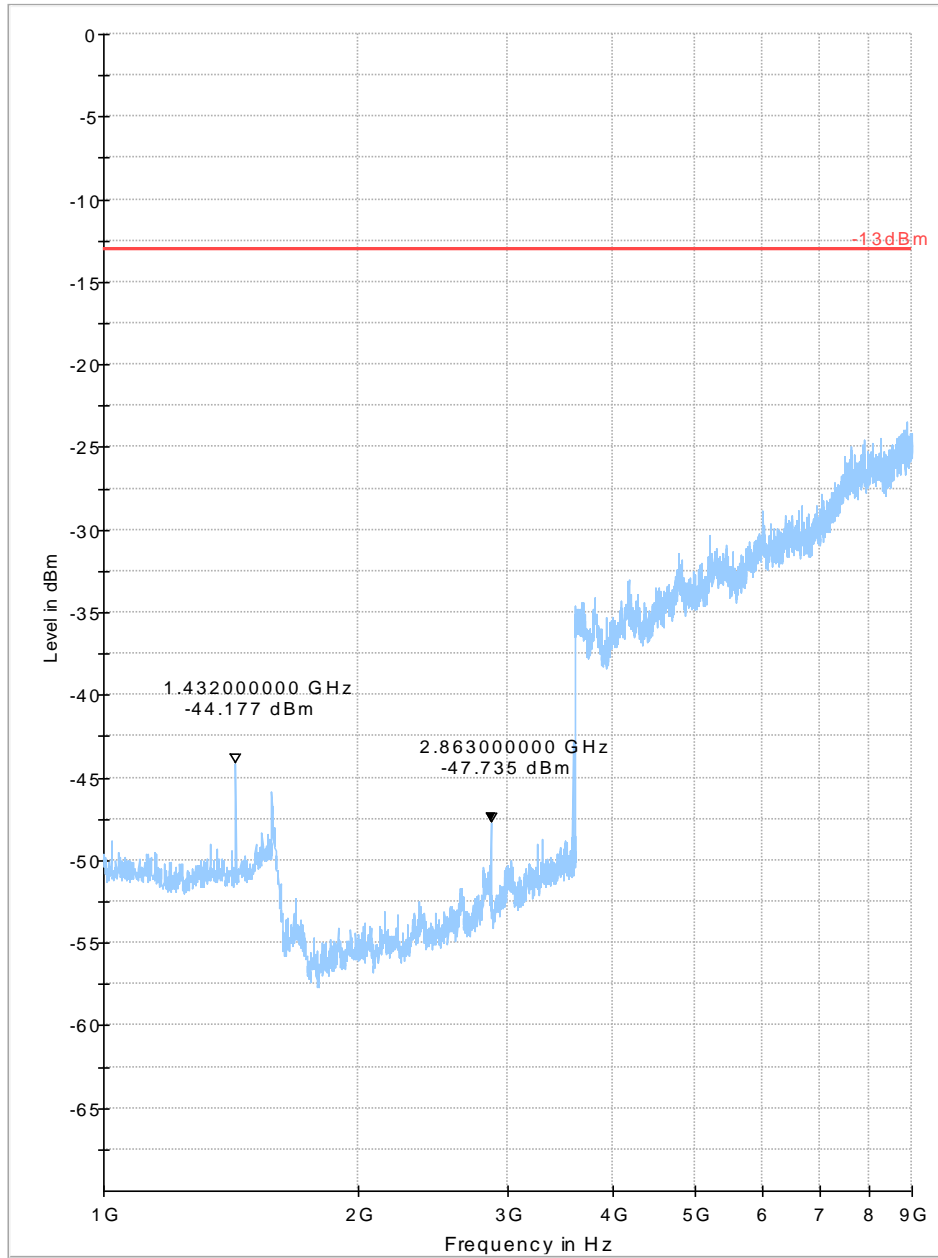


Note: The peak signal above is the transmit channel.



Plot # 53 Radiated Emissions: 1GHz – 9GHz

Channel: High



Preview Result 1-PK+ * Critical_Freqs PK+ -13dBm Final_Result P



8 Test setup photos

Setup photos are included in supporting file name: "EMC_XIRGO-117-17001_FCC_ISED_Setup_Photos.pdf"

9 Test Equipment And Ancillaries Used For Testing

Item Name	Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
Biconilog Antenna 3142E	Biconilog Antenna	EMCO	3142E	00166067	3 years	6/22/2017
Passive Loop Antenna	Loop Antenna	ETS Lindgren	6512	00049838	3 years	7/28/2017
Antenna Horn 3115	Horn Antenna	EMCO	3115	35111	3 years	7/24/2015
Antenna Horn 3116	Horn Antenna	ETS Lindgren	3116	70497	3 years	7/22/2015
Digital Barometer	Compact Digital Barometer	Control Company	35519-055	91119547	1 Years	6/5/2017
ESU . EMI Test Receiver	Test Receiver	R&S	ESU	1302.6005K40 -100251-KB	2 years	7/10/2017
Thermometer Humidity TM320	Thermometer Humidity	Dickson	AY1072	0528	1 Year	11/02/2016

Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.
 Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated "N/A" for cal status either do not specifically require calibration or is internally characterized before use.



10 Revision History

Date	Report Name	Changes to report	Report prepared by
10/26/2017	EMC_XIRGO-117-17001_FCC_22_24_27-ISED	Initial Version	Issa Ghanma